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THE TELEPHONE SERVICE.

ANOTHER Parliamentary Committee has concluded its labours and arrived at its report. Though not yet presented to Parliament, a copy of the report has found its way into the columns of a provincial newspaper, and as this publication has been stated by the chairman of the Committee from his place in Parliament to be the "amended" report, we are justified in considering it as substantially accurate and commenting upon it accordingly. The Committee considered mainly the desirability of competition, and the suitability of such competition being undertaken by municipal authorities. As a preliminary to such consideration there needed to be decided the question whether it would be justifiable to permit competition in view of the agreement between the National Telephone Company and the Post Office. To this point much of the evidence before the Committee was directed. This evidence may be divided into two classes, the official, which sustained the written agreement, and the semi-official, which leaves little room for doubt that some sort of understanding existed that competition was not to be undertaken. This view was whittled down to a sort of time limit, implying that competition was not to be immediately indulged in, but might at some future time be undertaken. The Treasury minute, agreements, and Acts of Parliament bearing on the question have been fully discussed in our columns, and we have noted from time to time how, in each, the right of the Post Office to compete, or to license others to compete, has been carefully preserved; but when it is remembered that the National Telelphone Company was under no obligation to sell its trunk lines, or to relinquish its rights to extended areas, and that the trunk lines were regarded as of great value in competition, it becomes easy to understand that it might have sought some equivalent for their surrender, and that, as Mr. Forbes suggests, the equivalent was found in an understanding or arrangement which did not find its way into the bond, whereby the company was to be left alone in local areas so long as its service was good, and the Post Office would protect its own interests by placing trunk line service on a par with telegraphs, the former thereby becoming one of the direct sources of revenue of the State. Upon the evidence before it, we do not see how the Committee could have arrived at any other conclusion than that the Government were free to grant licenses. It is quite possible to recognise the wisdom of a policy not to grant licenses without assuming that the policy was not open to revision. This is probably the explanation of otherwise irreconcilable views.

In the attitude of some members of the Committee, it would almost seem as if they must have come under the influence of the irresponsible chatter which sought to suggest that a sort of unholy alliance existed between the Post Office and the Telephone Company, and that the public suffered thereby. That the conclusions of the Committee are not in accordance with the views of the permanent staff may fairly

be deduced from the evidence. How far it may be wise for a Parliamentary Committee to disregard the conclusions of a Departmental staff on subjects which need careful study and experience, time may show.

The Committee concludes that the telephone service is not of general benefit, and is not likely to become so, so long as the present practical monopoly in the hands of a private company shall continue, but that it has become of much more general benefit in other countries, and might, "if worked solely or mainly with a view to the public interest," become a valuable instrument in further developing the trade and social life of the nation, towards which new means of communication have always hitherto so largely contributed. It is considered evident that the service has cost the company much more than it would now cost to replace it by a system at least equally good, and it is inferred that "this increased cost must naturally involve either a decreased dividend to shareholders or increased rates to subscribers." Fear is expressed that unless the Government had an alternative plant supplied wholly by the Post Office, or partly by municipal licensees, the purchase of the company's undertaking at a forced price might be imposed upon the Government in 1911, and this seems to have weighed with the Committee in recommending the granting of municipal licenses which, however, are to be governed by the conditions that they must terminate in 1911; the systems must be in accordance with the regulations of the Post Office which should insist on complete uniformity of system so far as the differing conditions of the different localities may permit; a maximum rate should be imposed "and no inducement be afforded to municipalities to carry on the service at a profit, and with a view to lighten the burdens of local taxation"; a minimum rate should also be imposed to protect the Post Office against the possibility of unremunerative rates in 1911. It is expected that this would "also act as a security to the company against undue competition, and at the same time protect the ratepayers against a charge upon the rates." A royalty of 10 per cent. is to be paid to the Post Office, in the same way as paid by the company. It will be a matter of surprise to many that the Committee should express the opinion that "the service given by the company is not generally inefficient, nor, for the class of subscribers whom alone it serves, can the rates be considered unduly high, though higher than are paid by similar subscribers in Germany," but the continuation of the same paragraph will meet with general approval, in that the Committee think that "a service already so essential to commercial men, and so well calculated, under other conditions, to benefit, directly or indirectly, all classes of the community ought no longer to be treated as the practical monopoly of a private company" under disadvantageous circumstances referred to.

This is, in fact, the condition which a responsible Department has had to consider. A practical monopoly exists without legal control or legal rights. The Committee might have made some recommendations tending to regulate a monopoly, or suggest steps for placing it under responsible management, but the Committee which recognises that "to the local public two competing systems in one locality are a source of inconvenience and expense alike," recommend the granting of municipal licenses for the purpose of bringing about this competition, which is to be undertaken with a certainty of making no profit, and with a delightful uncertainty of recoupment of expenditure on the expiration of the limited license. The anxiety of the Committee as to the position in 1911 seems to be an echo of recent newspaper agitation. The evidence of permanent officers at successive Committees has made it clear that the position has not been overlooked, but we have never understood the excessive anxiety on this question. Suppose nothing were done. In 1911 the company will have a plant without the possibility of using it; the Post Office will have the sole right of use without any plant. The assumption that the company would be in a position to force an unreasonable price is not, in our opinion, justified. The possession of the plant in one quarter, and the power to use it in other hands, offers a greater equality of circumstance than is generally recognised, and it would, we believe, result in an equitable arrangement, whatever efforts might be made to "corner" or coerce.

The observations of the Committee on the cost of the service again savour of ancient argument. It is doubtless true of any service that if it had to be created over again it could be done for less money, and it is undeniable that in the case of the Telephone Company, much of the capital is representative of enhanced value rather than actual expenditure. But what of it? Money cannot do everything. Time is needed to obtain a connection and acquire experience. Again, the advantages of improved means of communication so eloquently dwelt upon by the Committee are usually considered to go hand in hand with profit to the supplier. There are some few exceptions, but on the whole the most satisfactory railway companies to the public are those which pay dividends. It might be better for individuals if the General Omnibus Company reduced their penny fares to nothing, but it is doubtful if the advantage would extend to the community.

Whilst the advantages of competition are so obvious in the ordinary affairs of life, it cannot be expected that the average member of Parliament will realise the exception in the case of telephones. We think, however, that a Parliamentary representative of a Government department, such as Mr. Hanbury, should not wantonly waste the experience, acumen, and devotion, of the permanent staff of his department.

The Cost of Provisional Orders.

So much has been said regarding the heavy charges entailed in securing a provisional electric lighting order, whether the applicant be a company or a municipal authority, that it is of interest to record instances where the fees have worked out at a comparatively low figure. The Barking Town Urban District Council applied last year, under Mr. Hawtayne's advice, for a provisional order, and the costs have been made up as follow:—Board of Trade fees, £50; advertising, £33; printing orders, &c., £45; sundry expenses, £7; making a total of only £135, which compares very favourably with a number of cases where £300 or £400, and even more has been spent. Of course in many places the cost of fighting opposition comes out at a considerable sum. It seems to us that promoters of electric lighting orders should have some loophole such as the Light Railways Act for getting their schemes approved more expeditiously and economically. It will be remembered that recently Mr. Ritchie, the President of the Board of Trade quoted an instance of a railway scheme, for which, if full Parliamentary powers had been sought, the various charges connected therewith would have amounted to about £1,000, but as it was promoted under the very advantageous Light Railways Act the expenses came to about £150 only. Electric lighting companies would welcome some arrangement whereby they could secure a proportionate reduction in their charges, particularly where the area to be supplied is a very small one, upon which such expenses would tell somewhat heavily. We do not think, however, that the Electric Lighting Acts are altogether responsible for the heavy charges, for in Barking and a few other places, instances are found of what it is possible to do in the way of economy with careful legal management. It would be interesting to know what are the highest and lowest sums expended by any applicant for an order.

DUCRETET ON HERTZIAN TELEGRAPHY.

In a lecture delivered before the Société Internationale des Electriciens on June 1st, M. E. Ducretet describes a new arrangement of apparatus for automatically printing messages in the Morse code. This has, of course, already been done by Marconi, Slaby, and others who have worked at this subject, so that Ducretet's improvements are only in the details of the apparatus.

M. Ducretet gives a short account of the discovery of electric waves and their practical application to telegraphy without wires, in which the work of Marconi is scarcely mentioned, and much prominence is given to the discoveries of other inventors, chiefly French and Russian, that we do not hear much about in this country. According to Ducretet, Sarasin and de la Rive were the first to show that the efficiency of a Hertz oscillator was considerably increased by causing the spark to pass through an insulating liquid instead of air.

It is to Prof. Popoff, of St. Petersburg, however, that Ducretet gives the credit of being the first to discover telegraphy without wires in 1895; Marconi's discovery having been made in the following year. We do not intend to discuss these rival claims, but give here only the opinions of M. Ducretet.

Prof. Lodge in England, and MM. Le Royer and Berchem at Geneva, have since 1893 successfully employed Branly's tubes with filings instead of the Hertz resonator for detecting the presence of electric waves, generated at a great distance.

In 1890 Branly first showed the action of electric radiations upon discontinuous metallic substances such as filings, free or agglomerated in an insulating substance, and comprised between two conductors forming a circuit containing a battery and a galvanometer. These substances, originally insulators, or at least of very high resistance, became conductors when they were struck by an electric wave; and, besides, their conductivity was annihilated by a shock, only to reappear again when struck by another electric wave. The galvanometer placed in the circuit of the tube of filings deviated very strongly when the tube of filings was struck by an electric wave; and then returned to zero when the initial resistance was restored by a shock.

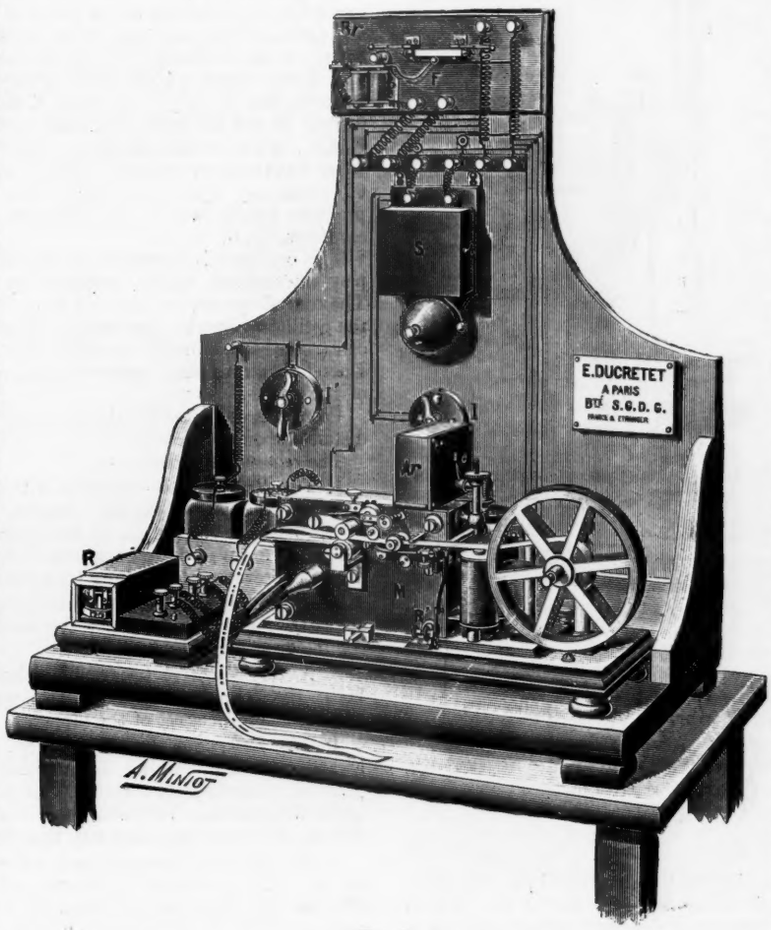


Fig. 1.

Branly has given the name of *radio-conductors* to his tubes of filings, a name which is intended to recall the fact that the conductivity of these tubes is established by electric radiations emanating from a spark. The sensitiveness of these detectors is very great, and they detect electric disturbances at a distance, even across partitions and walls. If the galvanometer is replaced by a sensitive telegraphic relay, fig. 2, we are able to produce in a local circuit energetic actions whose point of departure is the electric wave transmitted through space by an intermediary medium the ether, which propagates electric vibrations from the spark transmitter in the same way as it propagates luminous vibrations.

We have thus all the elements necessary to the realisation of Hertzian telegraphy; if the sensitive relay controls the electro-magnet of a recording apparatus, and long and short emissions of electric waves can be produced at a distance, then a message can be sent by the Morse code. The relay

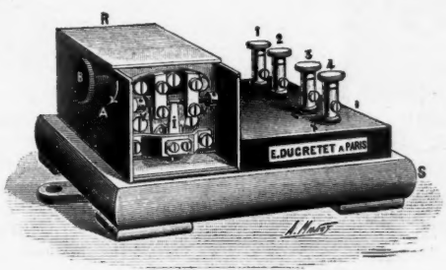


Fig. 2.

Fig. 5.

also controls the electro-magnet of the tapper which acts upon the filings of the radio-conductor. Each wave will thus be followed by a shock, bringing the radio-conductor back to its initial resistance. In practice the power of the transmitter will be adapted to the distance to be traversed.

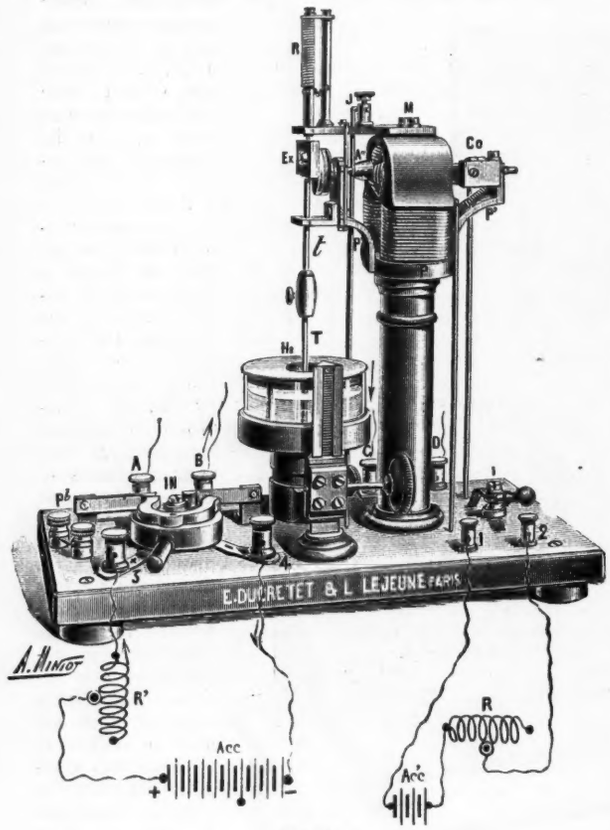


Fig. 4.

The apparatus described and realised by Prof. Popoff in 1895 was constructed as follows:—To record the electric waves produced by atmospheric electric disturbances at a great distance, he employed an instrument of the Morse type. Since 1895 Popoff has shown in various publications that his apparatus might be practically employed by the Marine for the transmission of signals. To augment the sensitiveness of his apparatus, Popoff connected one of the electrodes of his radio-conductor to a metallic wire, insulated, and fixed vertically along a mast. The other electrode was put to earth. This same arrangement may be applied to the spheres of the spark transmitter.

The insulated conductor of the receiving apparatus is a veritable collector of the electric waves launched into space; that of the transmitter plays the *rôle* of a radiator. Their length ought to correspond to the distance to be traversed.

The organs of the system of wireless telegraphy invented by Popoff may be shortly enumerated as follows:—*Electric waves* emitted by the *oscillator-transmitter*; a *Branly radio-conductor* which becomes conducting when struck by an electric wave and closes the local circuit of the relay which works the recording apparatus of the *receiver*; an *electric tapper* which acts automatically on the filings of the radio-conductor. Under the action of the shock of the tapper the conductivity of the tube of filings disappears, and recovers its original state till a new electric wave strikes the sensitive tube.

Ducretet's apparatus, which he showed to the Society, contains several improvements on the apparatus of Popoff. Like all telegraphic apparatus it consists of a *transmitter* and a *receiver*.

The *transmitter* comprises:—A powerful *Ruhmkorff coil* (fig. 3). In the circuit of the primary wire is a vibrating interrupter with a quick break, or a continuous rotary interrupter (fig. 4) according to the power of the coil. A special *key* produces the long and short emissions of waves. A battery of accumulators furnishes the electric energy.

It is this electric energy due to a current of a considerable strength, but of only a few volts E.M.F., which is transformed in the secondary coil, into a current of very high E.M.F., in the coil used in these experiments, 200,000 volts. After this transformation the electric energy does not exceed 60 watts, say $\frac{1}{12}$th of a H.P. This heightened E.M.F. produces sparks which play between the spheres of the oscillator, fig. 6.

This oscillator is formed of several spheres between which play intermittent sparks produced by the operating key. The central spheres are plunged in an insulating liquid, and the oscillating sparks play between them. This oscillator is constructed according to the data given by Prof. Righi, but Ducretet's arrangement insures a rapid control of the length of the sparks.

From this oscillator the electric waves start which act at a distance upon the *receiver*.

The *receiver* comprises:—

1. The *Branly radio-conductor* with its automatic tapper arranged according to Popoff. Ducretet's model has a device for regulating the position of the cylinders between which the filings are placed. The action of the external air on the filings is prevented by making the cylinders a good fit.

2. A mast with an insulated wire (Popoff's collector), and an earth connection to one of the electrodes of the radio-conductor as already described.

3. A very sensitive telegraphic relay putting in action both the electro-magnet of the recording instrument, and the electro-magnet of the tapper.

4. *The Recording Instrument* (fig. 1).—In Ducretet's arrangement the working is automatic, and allows the telegraphist to be dispensed with. This point he considers of great importance. The first wave that arrives starts the ribbon, and when the waves stop the ribbon stops.

Popoff has sent messages over a distance of 5 kilometres at sea, with a vertical conductor 18 metres in height. Marconi has traversed a distance of 16 kilometres with a vertical conductor 30 metres in height. Experiments made recently with Ducretet's apparatus show that these records can be beaten.

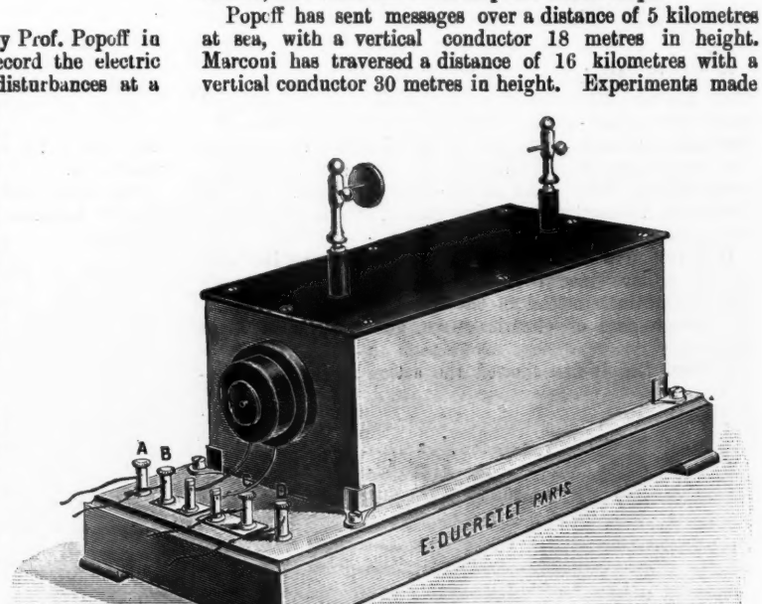


Fig. 3.

It is not necessary to conclude from these experiments that Hertzian telegraphy without wires will replace ordinary

electric telegraphy, or optical telegraphy; but from the results attained, it is possible to see the service it may render in communicating between ships, and between ships and the coast, and for military and exploration purposes. M. E. Aime is about to test wireless telegraphy as a means of communicating between balloons and the earth.

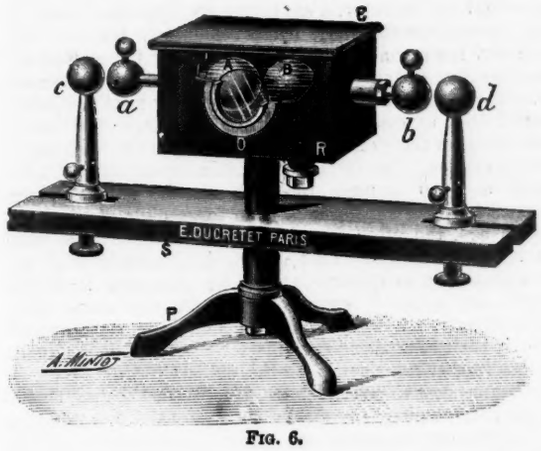


Fig. 6.

Branly has recently shown that a battery of 12 accumulators may be put in circuit with a powerful radio-conductor, and that the current may be raised from zero to 20 amperes, when the tube is struck by electric waves.

With a special kind of relay (un electro-aimant à déctie) Ducretet was able by means of electric waves sent from a distance to (1) Make a long metal wire incandescent. (2) Start an electromotor. (3) Excite a powerful electro-magnet. (4) Illuminate a row of incandescent lamps. (5) Explode a mining fuse.

DISTRIBUTION BY DIRECT AND ALTERNATING CURRENTS.

At the meeting of the National Electric Light Association recently held at Chicago, two papers were read which cannot fail to remind English readers of the old battle of direct *versus* alternating currents which was fought so vigorously years ago by their respective advocates at Institution meetings and in the press. One of these papers was by Mr. Ferguson, who took distribution by direct currents as his subject, whilst the other, dealing with distribution by alternating currents, was read by Mr. Wagner. The former consisted chiefly of a description of the system now used by the Chicago Edison Company, and was not by any means an aggressive or fighting paper; as, whilst arguing generally on the greater suitability of the direct current system for lighting and power service in large towns, Mr. Ferguson specially disclaimed any intention of blindly advocating the use of this system under all conditions, and, indeed, actually claimed that he was the first of the so-called Edison Central Station men to propose the introduction of the alternating current as a means of effecting important economies in the operation of a direct current distribution system.

The Chicago system is a multiple station system, with four stations, two of which are direct current generating stations pure and simple, whilst the other two are in part sub-stations. The largest station furnished about 75 per cent. of the total output, which amounted to over 15 million units in 1897; and these 11 million units were delivered to the business portion of the city covering an area of about one square mile, the electrical centre of which was only about 1,000 yards from the station. All four stations supply current to a three-wire network with 220 volts between the outer conductors; but at the two sub-stations, which are two or three miles in opposite directions from the main station, the direct current generators only furnish a part of the current required for the district served by them, as during the time of light load the network is fed direct from the main station, and during heavy load a part is, and eventually all the current will be, transmitted from the main station as a high pressure alternating current, rotary and stationary transformers being employed at both ends of the trunk mains to effect the necessary conversions. In other respects, the system is the ordinary Edison system, with a liberal allowance of copper in the mains, and Mr. Ferguson claims that they get better regulation and a steadier light on this system than has ever yet been obtained on any alternating current system in the United States. Other advantages of the direct current system, which are referred to in the paper, are the gain arising from the use of the storage battery, and the superiority of the direct over the alternating current for motor work, especially in the case of electric elevators, and for constant potential small current arc lamps.

Mr. Ferguson's conclusions are, that the direct current is more easily applicable to the various services required in a larger town; and that, as a low pressure distribution is essential to a satisfactory alternating current service, so that the difference of cost is only that between direct current feeders and alternating current feeders plus transformers, direct current distribution should form the basis of the general system in any large town where commercial lighting, elevator service and general power work account for a large proportion of the load; and that for districts where it is not possible to supply current from a station fairly close at hand, high pressure alternating currents may be used for transmission, but should be converted into low pressure direct currents for distribution.

Turning our attention now to Mr. Wagner's paper on "Alternating Current Distribution," we find a much more vigorous advocacy of the advantages of the system which he favours, and which is described in the paper. But first, it is interesting to note that the paper commences with the statement that for 10 years it has been predicted with persistent reiteration that for the distribution of current for lighting from central stations direct current was a thing of the past, and that in a few years the alternating current transformer system would hold the field without a competitor. To many, continues Mr. Wagner, this prediction may seem to have been fulfilled, considering the enormous number of alternating current plants, compared with direct current, that have been installed. And yet in England we find a large number of experienced engineers who predict that it is the single-phase alternating current that will soon be a thing of the past, and that the coming system is that of direct current distribution, aided, when long distances have to be traversed, by multiphase transmission. What appears to us most strange, in view of Mr. Wagner's statement, is that, according to him, the system which is almost universally used in the States is the house transformer system, which in England has already been so largely superseded by the sub-station transformer system with low pressure distribution on account of the higher efficiency and better pressure regulation of the latter. That the sub-station system is almost unknown in practice in the States is shown by the fact that Mr. Wagner describes it as the new thing which is going to put alternating currents ahead of the rival direct current, and that in the discussion on the paper this system is described as a new one which has not stood the test of time.

Mr. Wagner himself does not believe that the prediction referred to above has been fulfilled, as he says that, judged by the standard of the Edison three-wire undertakings, few alternating current stations in the States have been a success; but he asks that this admission should not be taken as an indication of any loss of faith on his part, as, in his opinion, the fault lies not with the alternating current itself, but with its application. The direct current plants have been installed with the object of providing a permanent investment, whilst with the alternating current the main object has been to deliver current for a minimum investment, and without consideration of the evil effects of bad regulation and low efficiency. Mr. Wagner therefore says we must take the good part of the direct current system, which is its low pressure distributing network, and replace the costly low pressure feeders by high pressure feeders with a transformer at the end of each, and regulate the pressure by pilot wires brought back from the low pressure terminals of the transformers. The effects of transformer drop on the regulation being thus eliminated, the $C^2 R$ losses in the transformer may be increased, so as to

allow of a substantial decrease in the iron losses; and if designed with this end in view, a 100-kilowatt transformer can then be built, which will have an average all-day efficiency of over 98 per cent. This is a remarkably good result, and we do not know of any English maker who has attained it; but Mr. Wagner quotes figures in comparing the relative efficiencies of different systems of distribution, which show a C^2 R loss at full load of 2·7 per cent., and an iron loss of only 0·23 per cent.

Mr. Wagner has installed a sub-station system, in which each high pressure feeder supplies a 110-kilowatt transformer at 1,100 volts, all the transformers feeding into a three-wire low pressure distributing network, and he compares the efficiency of this system with that of a three-wire direct current one, assuming in each case a full load loss of 2 per cent. in the distributors, and of 1 per cent. in house wires, whilst in the direct current feeder a loss of 24 per cent. is allowed, and in the alternating current system 8 per cent. loss is allowed for the feeders, and 2·7 per cent. for C^2 R, and 0 23 per cent. for iron losses in the transformer, all at full load. From these figures the efficiencies at various loads are calculated, and are given as follows:—

Load.	Direct current.	Alternating current.
Full	78 7 per cent.	87 9 per cent.
25 per cent.	94·1 „	95·8 „
20 „	94·8 „	96·2 „
15 „	96 1 „	96 5 „
10 „	97 3 „	96·4 „

It will be noticed that, according to these figures, Mr. Wagner claims a better efficiency for the alternating current at all loads down to 15 per cent. of full load, and that with any ordinary load factor he will get a loss of only about 4 per cent. between his generator terminals and the consumers' lamps; a result which, if it is confirmed by the readings of station and consumers' meters, must make our English alternating current station engineers envy him his happy lot.

The comparison, of course, depends entirely on the assumption of a 24 per cent. loss in the direct current feeders, and this was objected to in the discussion as much higher than was usual. As no idea is given of the average length of the feeders, it is impossible to make a proper comparison, and we would draw attention to the fact that the same omission is made in another part of the paper, where it is stated that "the Edison feeders for the same distance cost about 31 times as much as for alternating current at 1,100 volts." One would naturally suppose that the comparisons of cost and of efficiency would be made under the same conditions, but this can only be if we allow that a low pressure main costs about three times as much per pound of copper as a high pressure one. The actual figures, taking the weight of the three-wire main at 2½ times that of an outside wire, and the weight of the high pressure main at twice that of each wire, are as follows:—For the same percentage loss at full load, which means that the current density in the high pressure cable is five times that in the low, the weight of copper in the latter is 31¼ times that in the former; for the same current density, which makes the loss at full load in the low pressure main five times that in the high pressure, the weights are as 6¼ to 1; and for a loss at full load in the low pressure main equal to three times that in the high pressure main, which is the figure used by Mr. Wagner for the comparison of efficiencies, the weights are as 10½ to 1. This does not mean, however, that the costs of the mains laid are in the same proportion, as it is well known that the cost of insulation is relatively much less for the low pressure main, as is also the cost of trenching, conduits, and laying underground.

In the course of his paper Mr. Wagner claims to have shown that a properly-designed system of distribution by alternating currents will be cheaper in first cost, and will give a better efficiency and better regulation than the three-wire direct system. That this will be so when the mean distance between the station and the consumers exceeds a certain length, depending on the voltages used, no one denies; but it is asking a good deal to expect such a general claim to be admitted in regard to the lighting of large towns, when all experience up to the present time tends to show that, in England, at any rate, the large direct current undertakings can generate and deliver electrical energy at a lower total cost than alternating current undertakings of about the same importance, even although these latter employ the system advocated by Mr. Wagner.

With regard to the adaptability of single-phase alternating currents to the various services required in a large town, the paper claims that constant potential arc lamps can be operated as easily and as efficiently by alternating as by direct currents, and that a great saving can be effected in street lighting with series arc lamps by operating them by alternating currents. Mr. Wagner mentions that one large company has taken this matter in hand, and has effected a considerable saving in fuel and attendance by doing away with the small army of series arc lighting machines which were needed to run its 2,600 street arc lamps; and that it now operates them on the same circuits of 60 or 80 in series, using a step-up transformer of a maximum capacity of 4,000 volts and 10 amperes for each circuit, and supplying current to these transformers from large alternators, one of which can, and often does, supply the current for as many as 2,000 arc lamps. That it should be possible to do this is a great step in advance, and it would appear to be well worth the while of engineers who are now using direct current series arc lighters, or who are taking the trouble to rectify their alternating currents for their arc light circuits, to get further information on this subject.

Coming now to power service, Mr. Wagner claims that he can obtain single-phase motors which equal the multiphase and direct current motors in efficiency and facility of starting under load, and of being operated at variable speed; in fact, they equal the direct current shunt motor in all points but one, and excel it in efficiency and simplicity. The one exception refers to the operation of high speed elevators, and even here Mr. Wagner feels confident that all that is wanted is a little more time to perfect the apparatus, and then this application will also be made successfully. Finally, with regard to the use of storage batteries, Mr. Wagner holds that it has not yet been shown that they are a valuable adjunct to a central station, when cost and maintenance are duly taken into account; but he claims that, if their value is proved, they can be used on alternating current systems in conjunction with rotary transformers, just as in some direct current systems high pressure transmission to outlying districts is effected by the use of rotary and fixed transformers.

The discussion which followed the reading of these papers was not as animated as those which took place some years ago in London, but it resembled them in one particular, viz., that everybody seemed to finish off with the same opinions as they held at the beginning. Mr. Dow was the principal speaker on the direct current side, and attacked some of Mr. Wagner's figures of relative efficiency of the two systems; first, because he considered the 24 per cent. feeder loss attributed to the direct current system was much greater than was generally the case; and, further, because he took exception to the assumption that the distributing networks would be the same for both systems. He maintained that to get the same regulation in the network with a good motor and arc lamp load, the alternating current system would require a larger capital investment than the direct current system. Mr. Rice spoke in favour of multiphase systems, which Mr. Wagner had referred to as not being successful when the load was largely a lighting load, and expressed his opinion that alternating current motors and arc lamps would be as widely used as those of the direct current type, as soon as time had been given for their development. Mr. Pillsbury, who has done a great deal of work on alternating current single-phase motors, confirmed Mr. Wagner's statements, and said that these motors were now made equal, if not superior to, direct current motors; that the power factor was considerably above 90 per cent. for any load between half load and 50 per cent. overload, and above 80 per cent. at one-fifth load; and that for general power work the single-phase motor was better than the direct current one, as regards care and attendance required, average efficiency, and absence of wear.

The question of which system is the better one to use can only be decided after due consideration of the special conditions of each case, and we heartily agree with the views expressed by several speakers, who said that they were using both systems, and could not afford to spare either, as each had its special advantages, and each was better than the other under certain conditions favourable to its use.

CORRESPONDENCE.

Sparking.

I shall feel obliged if you will kindly give me, through the REVIEW, an answer to the following:—I am in charge of several dynamos, but one in particular does not satisfy me. It is made by a well-known maker, and the fault is, that no matter how I have tried to adjust the brushes it will persist in sparking at the two bottom brushes; the two top brushes are perfectly sparkless. The machine is a 100-volt 60-ampere compound, running at 1,200 revolutions per minute; it has a Gramme ring armature running in wrought-iron undertype fields. The field magnets are bored so as to leave $\frac{1}{16}$th of an inch clearance around the armature. Would it improve matters if I re-bored the field magnets so as to allow a little more clearance.

J. W. Bern.

[The sparking at lower brushes is due to the unequal magnetic flux, that being greater in the upper half of the ring than in the lower.

Bore out the magnets $\frac{1}{16}$th inch wider, and drop the armature down $\frac{1}{16}$th, so that it is nearer the lower horns of the magnets; or you may bore it $\frac{1}{16}$th inch eccentric, taking the whole cut from the upper polar edges. In short, you must equalise the flux by adjusting the distance of the armature from the upper and lower pole edges.—EDS. ELEC. REV.]

Protection of Railway Traffic.

The proposed system of railway signalling described in your issue of August 6th is not by any means a new idea, as it was fully explained by me in a letter to the *Daily Chronicle* 12 years ago, during my residence in Ipswich.

Fred. Feltham.

Gloucester, *August 9th.*

IMPROVEMENTS RELATING TO ELECTRIC TELEGRAPHY.

THE complete specification (No. 18,644—A.D. 1897) of Lodge and Muirhead's patent for telegraphing by means of Hertzian waves is just published, and we extract the following particulars relating thereto:—

This invention relates to systems of telegraphing by means of Hertzian waves, and has for its objects to provide means whereby greater certainty of action is obtained, and whereby the distance between the emitting and receiving apparatus may be materially increased.

In carrying out the invention the inventors use in the receiving circuit a recording or receiving instrument as indicated at *a*, connected in series with a battery, *b*, and a coherer, *c*, of the construction hereinafter described or other suitable form. The receiving instrument is a Kelvin siphon recorder, but it may be a telephone or other instrument able to respond to slight fluctuations of current.

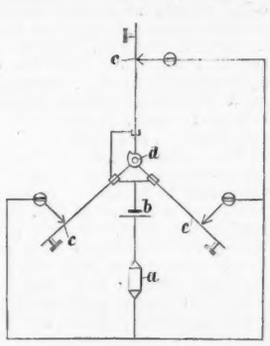


FIG. 1.

The coherer, which may be of any suitable construction, is of that form now known as a "single-point" coherer. According to the present invention, however, two or more coherers are employed (the diagram fig. 1 shows three) joined up in multiple arc, and in conjunction with them is a rotating or vibrating tapper or cam, *d*, which is kept in constant motion, preferably by means of clockwork, and is so placed relatively to the said coherers that it comes into contact with each one successively during every period or revolution. The object of this arrangement is to ensure that at least one coherer shall be in its receptive condition.

The construction of the coherer may be such that decohesion or the restoration to sensitiveness of its active part after every passage of the Hertzian waves takes place in the sensitive part itself instantly after the act of cohesion, without the aid of vibrating hammers or similar devices. Fig. 2 illustrates this form of coherer. Suitable

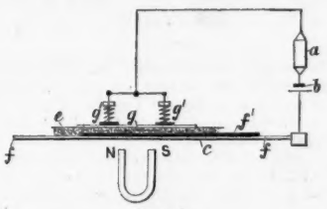


FIG. 2.

filings, *e*, forming a conducting mass, are spread out on a flexible light strip, *f*. This strip is suitably supported in the magnetic field between the two poles N S of either a permanent magnet or an electro-magnet. When the strip is made of aluminium or other suitable metal, there is placed between it and the filings an insulating film, f^1, of varnish or other material. It will be seen that at one end of the strip, *f*, the filings extend beyond the insulating film, f^1, whilst at the other end the latter effectually separates the filings from such strip. A second smaller light metallic strip, *g*, is maintained by light springs, g^1, upon the filings, *e*. When, under the stimulus of Hertzian waves, electrical cohesion or more complete contact takes place, a stronger current from the battery, *b*, flows through the whole length of the strip, *f*, to the mass of filings, and thence through the upper strip, *g*, to complete the electrical circuit, the result being a greater deflection of the strip, due to the action of the magnetic field. The bending or deflection in one direction of the strip, *f*, disturbs the mass of filings, and separates them, thus breaking down the cohesion previously existing between them. The coherer may be confined within any suitable casing.

As transmitter there may be employed an ordinary extra current spark, such as occurs when the current of a voltaic battery is broken, or when a current round a self-induction coil is varied, or started, or stopped, or any other means of producing an electric jerk or discontinuous or transient current such as are capable of exciting a coherer, but the inventors prefer to use an induction coil with one or more spark gaps. The effect of these electric jerks may be conveyed to the distant coherer either through space or along conductors of any kind, or along bare wires, or the outer sheathing of cables, or any other good bare conductor leading from the sending station to the receiving station.

Sometimes a condenser is connected between the earth and the terminal of the coherer opposite to that which is connected to the telegraph wire or conductor to increase the effect of the arriving electrical impulse upon the coherer.

When synchronous collectors or resonators are employed, the inventors in some cases connect the coherer to the extreme end of the resonator, when a single resonator is used; or when a pair of equal resonators is used end to end, the coherer is placed between the inner ends of the resonators. In this arrangement the battery and receiving instrument connections, if made to the resonator at all, are made at the middle of the resonators, otherwise they would disturb the oscillation period. The coherer being a non-conductor normally does not disturb the resonators.

Another arrangement is with a large closed circuit similar to one of Hertz's arrangements, in which little sparks occurred between the discharger knobs. At that same place is put the coherer, and in another part of the circuit is placed the battery and receiving instrument, but to avoid the disturbance of time period caused by their introduction they are shunted by means of a condenser of sufficient capacity to act as a virtual short circuit for oscillatory currents.

The addition of a condenser as a shunt to any simple coherer circuit in this manner, eliminates battery and receiving instrument, so far as oscillations are concerned. This use of a condenser in coherer circuits, such as will enable them to have a definite time period, in spite of their containing also a battery and recorder, or telephone or other complications of coils and the like, forms a distinct part of the invention.

A convenient arrangement of adjusting the sensibility of the coherer circuit is to place the coherer in one arm of a Wheatstone bridge arrangement, so that the receiving instrument responds whenever the coherer changes in resistance. An electro-magnet may be placed in another arm of the Wheatstone bridge arrangement, so that whenever the coherer diminishes in resistance, through the influence of electric stimulus, the electro-magnet loses much of its force, and so can drop a keeper on to the coherer to tap it back. The electro-magnet holds the keeper on until the change in coherer resistance causes it to drop off, without any tendency to "tremble." The electromotive force applied to the coherer can, in the above arrangement, be adjusted to any fraction of the battery employed. The coherer is a known kind, consisting of a tube of metallic or other filings or powder, but obviously any other form may be employed.

Of the various alternatives mentioned, the method at present preferred is a spark gap at the sending end of the system excited by a Ruhmkorff coil, with a bare wire or mere earth connection leading to

a coherer at the receiving end, the other terminal of the spark gap and of the coherer respectively being each connected to one of a pair of elevated conductors, or "sky-plates," such, for instance, as a pair of insulated roofs.

The sky-plate, instead of being a mere emitter, or collector, may be a syntonic radiator, or resonator. The claims are eight in number.

THE CONSUMPTION OF POWER IN RAPID SERVICE.

It is a fallacy to suppose that because the rapid acceleration of a train calls for a rapid expenditure of energy, therefore it is an economy to run trains at moderate speeds. Mr. A. H. Armstrong deals very fully with the question in the *Street Railway Journal*. He takes as a basis for argument a train running from point to point in a given time and shows that the best economy, with a fixed braking power of 150 lbs. per ton for each case, is secured when acceleration is rapid, and the train runs by inertia from the point of cut-off of power to the point of brake application. With the more rapid accelerations this free running time is longer and the braking time is shorter. Less energy remains to be destroyed by the brake shoes, apart from the wear of these and of the wheels, when speed is got up rapidly.

In a mile run of 140 seconds a tractive force of 200 lbs. per ton for 20 seconds, the train friction being 20 lbs. per ton, allows of a run by inertia of about 108 seconds and the brake occupies about 12 seconds. The energy expenditure is thus 4,000 pound-seconds. At a tractive force of 80 lbs. the energy is kept up about 64 seconds, inertia running lasts about 59 seconds and the brake destroys energy for 17 seconds. The maximum velocity for all tractive forces between 80 and 200 lbs. is practically the same, varying from about 40·5 to 41·4 miles per hour. Below 80 lbs. the maximum speed has to be much higher until at 63·4 lbs. per ton a speed of 51·3 miles is reached in 108 seconds when the brake is at once required to stop the train at the 140th second. In this case there is no running by inertia. The system of running a train by inertia from a point of power cut off may not inaptly be compared with the working of steam expansively. Rapid acceleration by high tractive effort is the equivalent of high pressure steam at early cut off. The free run of the train is equivalent to the expansion of the steam, while the brake action may be compared to the exhaust opening. For mere expenditure of energy it is thus obvious that motors must be the largest possible or practicable. Energy must be capable of rapid expenditure. All this implies more copper in the line, and greater fluctuation of power; and in dealing with every case regard must be had to the elements of line loss and interest on the amount of copper invested in the line before the economical rate of acceleration can be determined. Frequently, however, these points will not govern the working of a line. Time between stops is an important and often a governing element. Brakes must be applied in a wasteful manner, and trains must not only be run up to maximum velocity, but maintained at that by the expenditure of energy equal to the train resistance. By means of the various curves submitted by the author all the problems of a line can be worked out on the engineering basis, and the acceleration and braking effect proportioned to the schedule speed. One may not always be able to secure best absolute economy. It is a great thing if the best possible economy for given conditions can be ascertained and suitably corrected as regards expenditure of copper. It is the demand for rapid transit which has put motors of 25 horse-power upon comparatively small cars. The question has been throughout the whole progress of electric traction one of mean duration of run, and this has proved to be reduced to the lowest time where the acceleration has been rapid, while at the same time a low maximum speed has not yet been exceeded.

THE ADVANTAGES OF MECHANICAL DRAUGHT.

The advantages of mechanical draught are many, and were ably put in a paper by Mr. W. B. Snow before the June meeting of the North-West Electrical Association of America. A high chimney is required to produce a draught, but a low chimney is sufficient simply to get rid of the furnace gases at a sufficient height above ground. This results in first cost economy of considerable degree, for a tall chimney demands an expensive foundation, especially in bad ground. As regards the primary object of a chimney, viz., the draught it produces, it is obvious that rapid changes are not possible in the intensity of action. A chimney works by difference of temperature; with a slow fire the draught must be a minimum. A stronger draught can only be had by a gradual intensifying of the fire up to its maximum, the chimney becoming gradually hotter as the fire gets up. In fact, the fire and the chimney act and re-act until the maximum effect is produced. A fan, on the contrary, can be put into full work by the simple turn of a switch or its equivalent and it can as quickly be checked. With an engine of, say, 800 H.P., about 200 H.P. out of the 1,000 H.P. generated in the furnace will go to cause the chimney draught. But a fan for the same draught effect will not consume a fraction of 200 H.P. This brings one to another aspect of the question. In designing plant for fan draught it is necessary to provide more heat absorbing surface to absorb low temperature heat. No heat is wanted in the fan. If the furnace gases are still to pass away at the same high temperature, a large incentive to the use of a fan will disappear.

Economisers reduce temperature very much, but they work at the boiler pressure and temperature, and cannot cool the gases below such temperature. Economisers should thus be placed in series, and the last in series, that nearest to the fan or chimney, need not, indeed should not, be worked at boiler pressure. It may even be worked at the atmospheric pressure, and simply supply heated water to the main feed pump. The trouble with economisers is well known to be the external corrosion due to condensation on the pipe surfaces of the acid vapours of the gases. To prevent this there ought to be a positive system of circulation in the economiser by means of a pump of larger capacity than the feed pump, in order that the fresh feed shall only be a given fraction of the total circulation.

Thus if the water supply comes in at 60° and goes out finally at 140° from this first economiser, and it is necessary that no part of the economiser fall below 113°, then must the circulating pump be about three times as big as the feed pump. The total addition of temperature is 80°, or, say, 27° in each circuit. Mr. Snow does not deal with this aspect of the question, but trusts to the economy which would result from the reduced weight of air, and the consequent lower velocity past the heating surfaces and lower final temperature. Much may be thus effected, for fires may be made thicker, and inferior fuel may be employed, this latter often being the largest economy which is possible by means of fans. The aim in steam production is to produce steam at constant pressure, and to this end the draught fan ought to be automatically regulated to increase its speed as the steam pressure falls and *vice versâ*. In the course of the discussion one speaker threw doubts on the value of fan draught and economisers and stokers for small plants, and no doubt he was, to a certain extent, right. Before installing such things it is necessary to be well assured they will pay interest charges, &c., and doubtless the problem is much simpler in some respects in larger stations. For new work, too, the problem is far simpler than where there is already a complete plant, and perhaps a chimney already built. In such a case a fan is an extra charge only to be adopted if necessary for sufficient draught, or an economy can be effected in the reduction of the chimney temperature. Where there is already a chimney it will serve to reduce the power to be expended on the fan, for, roughly speaking, a fan only absorbs power in proportion as it puts in motion a given weight of air. In abandoning chimney draught there is no need to look on the chimney as a piece of dead capital, for to a certain extent it will continue to save fan engine power. A plethora of labour-saving devices is possible. They may exist in such numbers as more than outweigh their advantages, and in adopting a new device the advice of an experienced engineer may be remembered, if not always acted on, that each appliance should be able to save a fourth of its cost annually, or it is not worth applying.

LEGAL.

The Brockie-Pell Arc Lamp Patents.

In the Chancery Division on Friday, before Mr. Justice North, Mr. Swinfen Eady, Q.C., moved on behalf of the Brockie-Pell Arc Lamp Company, Limited, for an injunction restraining Messrs. Johnson and Phillips from representing by advertisement or otherwise that the arc lamps in use at Portsmouth and other places, and which were in fact manufactured under the Brockie-Pell patents were the lamps of the defendants, or from representing that they were in a position to supply lamps made under those patents. Counsel stated that the plaintiffs were the owners of the Brockie-Pell patents which related to the internal mechanism of arc lamps for regulating the feed, and the defendants from 1885 to 1897 held a license to manufacture and supply lamps under those patents. Between that period the defendants no doubt fitted up installations at Portsmouth and other places which had proved very successful. Then on June 30th, 1897, the license being already at an end defendants gave an undertaking not to manufacture any more lamps under the patents, and by agreement the plaintiffs took from them 706 arc lamps which at that time they had in stock. Now what the defendants were doing was to extensively advertise in the Electrical Review and *Lightning*—"Johnson & Phillips arc lamps, absolutely steady and reliable; over 14,000 in use for street lighting in St. Pancras, Hammersmith, Portsmouth, Brighton, and elsewhere." Now the lamps in use in those places were manufactured under the plaintiffs' patents, and the effect of these advertisements was to lead people to believe that the defendants were still in a position to supply lamps made under the patents, though, as a matter of fact, they had given an undertaking not to manufacture them, and could not in fact supply them. That, he submitted, was a thoroughly dishonest advertisement, and was calculated to take away custom from the plaintiffs. People would go to the defendants, thinking they were still in a position to manufacture Brockie-Pell lamps, and would probably, in the result, be supplied with something which did not infringe the plaintiffs' patent.

Mr. Justice North: If they cannot supply the Brockie-Pell lamps, so much the worse for them. How can it injure you?

Mr. Swinfen Eady: As I have remarked, it will take persons desirous of having an installation of our lamps to them, under the impression that they are still in a position to supply them, and who would otherwise come to us.

Mr. Justice North: The statement is true, I suppose, that these lamps were supplied by them? This is quite different from the usual

complaint, the passing of their lamps as the lamps of the plaintiffs. I don't recollect any case like this.

Mr. Eady: It is all part of the same process. The ingenuity of man is constantly devising new methods. I am not aware of any case like this, but I submit it is a case in which the Court will be justified in interfering.

Mr. Justice North: The Court is not in the habit of restraining falsehoods.

Mr. Eady: I ask that the defendants may be restrained from representing that they are in a position really to supply lamps made under the plaintiffs' patent, and from holding out that the Johnson and Phillips's lamps are our lamps.

Mr. Justice North: I fail to see how the advertisement applies to your patent, which really relates to a small part only of the mechanism of the lamp.

Mr. Eady admitted that to be so, but said the advertisement referred to lamps which it was not disputed were manufactured under the plaintiffs' patents.

Mr. Justice North: If they had said in so many words that they were in a position to sell Brockie-Pell lamps, it would be a different matter, but they do not.

Mr. Eady: No: but the inference is that they can.

Mr. Justice North: What they say is that these lamps were manufactured by Johnson & Phillips, which is true.

Mr. Eady: Yes; but they cannot now manufacture lamps of the same kind. The advertisement contains the words "absolutely steady and reliable," and that is the great feature of our lamps. And then they call them Johnson & Phillips's lamps.

Mr. Gray, on behalf of the defendants, submitted that his clients were perfectly justified in advertising as they had done, because every single word in the advertisement was absolutely true. The defendants were a firm making amongst other things arc lamps, and they had up to January 29th, 1897, made the Brockie-Pell lamps under a license. It did not appear that the Brockie-Pell lamps were the only lamps made by the defendants. There was no statement in the advertisement that the lamps in question were the Brockie-Pell lamps. The defendant firm made these arc lamps when orders were given to them, and the defendants were paid for them. It was not then as if the plaintiffs had supplied the lamps, and the defendants had merely taken the orders. The lamps were ordered, supplied, and paid for between the defendants and the purchaser. Even supposing this advertisement, on being read, inferred that the defendants made the Brockie-Pell lamps, the plaintiffs had not pointed to a single case in which someone asked the defendants for Brockie-Pell lamps, and in which the defendants supplied something which they said was a Brockie-Pell lamp, but which was not. His learned friend had said that the particular characteristic of the Brockie-Pell lamp was that it was absolutely steady and reliable. There was, however, no evidence as to that from beginning to end; every word in the advertisement was absolutely true. Even supposing there had been a case for an *interim* injunction, the plaintiffs had been guilty of *laches*, and very serious *laches*, as the advertisements in question had been appearing in the Electrical Review and in *Lightning*, and possibly in other papers, constantly since March 3rd. His submission was that the advertisements were absolutely true, and that there was no representation in any way that the defendants were making Brockie-Pell lamps. Further, the plaintiffs had publicly advertised in the very papers that the advertisements in question appeared that the defendants had no right to and did not manufacture the Brockie-Pell lamps, and if the advertisements had had the effect the plaintiffs alleged they had, they had not produced a single case to show that where anyone had asked the defendants for a Brockie-Pell lamp they had been supplied with a lamp not of that manufacture, but one made by the defendants.

Mr. Swinfen Eady having replied,

His Lordship, in passing judgment, said that the delay was such as to prevent him making any order now. He did not, however, decide the case simply on the question of time, but he did not think it was a case in which he could interfere by interlocutory injunction. If the advertisement was misleading, as it was suggested, it ought not to be so. But even assuming it was meant dishonestly, still it was not a matter in which the Court could interfere. The motion would be dismissed, the costs to be costs in the action.

County of London and Brush Electric Lighting Company *v.* Godfrey Bros.

Before his Honour Judge Lushington, Q.C., at the Wandsworth County Court recently, the County of London Brush Electric Lighting Company, of the Causeway, Wandsworth, sued Messrs. Godfrey Bros., of 40, Trinity Road, Wandsworth, to recover the sum of £14 9s. for electric light supplied.

Mr. Hopkinson, solicitor, appeared for the company, and Mr. Wallis, barrister, defended.

The hearing of the case occupied a considerable time, the difference between the parties having apparently arisen over a sliding scale arranged by the company, by which a rebate was allowed on a certain quantity of electricity being consumed. The evidence of the company's witnesses was to the effect that on January 1st defendants' indicator showed 500 units. This was proved to have been duly registered on defendants' meter card. For the next quarter the amount registered was 600 units, but the employé who took the readings and registered them was not present in Court.

His Honour said that as the first reading was proved he should allow no rebate, but he should do so on the second quarter, inasmuch as it was not proved.

Defendants' counsel contended that under plaintiffs' contract note, signed by the defendants, a rebate should be allowed on the first quarter.

His Honour gave judgment for the plaintiffs for £12 10s., with costs. The defendants had paid into Court the sum of £10 17s. 11d.

His Honour remarked that the company's sliding scale appeared to be very ambiguous.

BUSINESS NOTICES, &c.

Electrical Wares Exported.

Week Ending Aug. 9th, 1897.	£	s.
Aden. Teleg. mat. ...	35	0
Albany	96	0
Alexandria. Teleg. mat.	44	0
Amsterdam	285	0
Antwerp. Elec. fuses ..	295	0
Bangkok	65	0
Bombay	87	0
Buenos Ayres... ...	100	0
" Teleg. mat.	272	0
Cadiz	1,950	0
Calcutta	863	0
" Elec. fuses ...	18	0
Cape Town	1,092	0
Carthagena	338	0
Christchurch	142	0
Colombo...	103	0
Delagoa Bay	142	0
Durban	153	0
Flushing	15	0
Fremantle	35	0
Gothenburg	60	0
Hamburg	29	0
Malaga	200	0
Melbourne	54	0
Otago	150	0
Para. Teleg. mat.	52,500	0
Port Elizabeth	414	0
Rangoon	37	0
Shanghai	251	0
Stockholm	700	0
Sydney	354	0
" Teleg. mat. ...	493	0
" Telep. mat....	54	0
Trinidad	20	0
Vigo. Teleg. mat. ...	205	0
Total	£61,652	0

Week Ending Aug. 9th, 1898.	£	s.
Adelaide	146	0
Alexandria	58	0
" Teleg. mat.	20	0
Amsterdam	205	0
Antwerp...	329	0
Auckland	166	0
Bergen	7,518	0
Bombay...	200	0
Boulogne	82	0
Bremen. Teleg. mat....	150	0
" Sub. cable ...	180	0
Buenos Ayres	6,355	0
Calcutta...	243	0
Cape Town	602	0
Copenhagen	19	0
Durban	2,838	0
East London	81	0
Fremantle	30	0
Hamburg	210	0
Helsingfors	29	0
Kolding. Teleg. cable	252	0
Liban	54	0
Lyttleton	47	0
Madras	86	0
Marseilles	50	0
Melbourne	40	0
" Teleg. mat.	410	0
Montreal	25	0
Odessa	130	0
Penang	25	0
Port Elizabeth	819	0
Rangoon	55	0
Rockhampton	172	0
St. Petersburg	14	0
" Elec. launch	1,300	0
Shanghai	260	0
Stockholm. Teleg. wire	72	0
Sydney	680	0
" Teleg. mat. ...	90	0
Townsville. Teleg. mat.	125	0
Wellington	37	0
Yokohama	27	0
" Elec. cable	480	0
Total	£24,711	0

Foreign Goods Transhipped.

	£	s.
Calcutta	32	0
Colombo. Elec. fittings	353	0
Total	£385	0

	£	s.
Batavia. Teleg. mat. ...	11	0

Acetylene.—We have received a number of circulars relating to various generators and other apparatus connected with the production and use of acetylene. The lists show some of the apparatus which is being exhibited at the Imperial Institute by a number of firms, including the Acetylene Illuminating Company, of Foyers, the Acetylene Gas Corporation, and others. The Acetylene Illuminating Company shows specimens of carbide of calcium, which, as our readers are aware, is a product of the electrical furnace, and is made from a mixture of powdered lime and carbon, the acetylene gas being evolved by bringing it in contact with water in some form of generating apparatus, of which there are various kinds exhibited at the Institute just now.

Books Received.—"La Traction Electrique sur voies ferrées." Par André Blondel et F. Paul-Dubois. Two vols. Paris: Baudry et Cie, editeurs. 50 francs.

"Electricity and Magnetism: a Mathematical Treatise for Advanced Undergraduate Students." By F. E. Nipper, A.M. Second edition. J. L. Boland, Book and Stationery Company, St. Louis, U.S.A.

"Radiation: an Elementary Treatise on Electro-Magnetic Radiation, and on Röntgen and Cathode Rays." By H. H. F. Hyndman, B.Sc. With a Preface by S. P. Thompson. London: Swan, Sonnenschein & Co., Limited.

Business Announcement.—Messrs. J. Carter, Sons and Co., engineers, machinists, &c., New Bailey Street, Salford, have purchased the business of the late Mr. E. J. Oxley, mill and machine ironmonger, &c., Port Street, Manchester.

Cable Making in Germany.—The Land und Seekabelwerke Aktiengesellschaft of Coln-Nippes, are circularising to the effect that they have taken over the cable works of the firm of Franz Clouth, Rhenische, Gummi-Waaren-Fabrik, including the Berlin branch, and will carry on the manufacture of land and submarine telegraph cables, also insulated wires. The directors of the company are Herren Friedrich Grimsehl and Georg Zapf, and the managers are Herren Theodor Grosswendt and Georg Bartels.

Change of Address.—Messrs. Rowland Carr & Co., electrical engineers' stores, &c., have removed to more commodious offices at 6 and 8, Lime Street Square, E.C.

Electric Drill.—The Tees Commissioners have decided to purchase a portable electric drill from Messrs. Ernest Scott and Mountain, for the Graving Dock at South Bank. The question of providing accumulator plant has been deferred.

John Swailes & Co., Limited.—At the Chancery Court at Liverpool on Monday, an application was made before Vice-Chancellor Hall to reduce the capital of this company, which was formed last year by some electrical engineers for the purpose of taking over and working their business. The capital was £35,000, divided into 7,000 shares of £5 each; 6,000 shares were issued and fully paid up. The company started with assets taken at considerably greater value than they were proved to possess, and it was now sought to reduce the capital by £2 per share. The Vice-Chancellor sanctioned the proposal.

Lists.—Messrs. W. H. Spencer & Co., of Hitchin, have sent us lists of their horizontal engines (2 to 12 H.P.) which are recommended for driving electric light machinery, as the governors act as a complete automatic expansion gear; also high speed engines (4 to 12 H.P.) and Hopwood's patent vertical water-tube boilers.

The Manchester Electric Company, of Bradshaw Street, Manchester, have brought out a catalogue (B) of electric bells, indicators, microphones, telephones, switchboards, and accessories. Prices, reference numbers, and illustrations are given of a large variety of this class of goods.

A number of lists have been sent to us by Le Carbone, of Carteret Street, S.W., in which are detailed carbon brush-holders, the Lacombe and other batteries, and various specialities.

London Provincial Electrical Company, Limited.—On Wednesday, before Mr. Justice Wright, sitting as an additional judge of the Chancery Division for the purpose of dealing with applications for the winding-up of public companies, a petition was presented by Messrs. Paddison, Son de la Chapelle & Co., for the compulsory winding-up of the London Provincial Electrical Company, Limited. The petitioners were judgment creditors. The company was formed in June, 1897, with a nominal capital of £60,000, and some 1,707 of the shares had been issued. The matter had stood over to see if some arrangement could be arrived at, but failing this, counsel for the petitioners now asked for a compulsory order, the petition being supported by other creditors. Counsel for the company stated that the judgment creditors were really secured. His Lordship made the compulsory order asked for, but intimated that if an arrangement was come to, there could be an application for a stay.

The Milton Aluminium Works.—During the summer meeting of the Institution of Mechanical Engineers at Derby the week before last, a large number of the members took advantage of an invitation from the directors of the British Aluminium Company, Limited, to visit their rolling mill and foundry at Milton, Staffordshire, on Thursday, 28th ult. During the visit a large aluminium pan was cast, weighing about 9 cwts., to be utilised in connection with the manufacture of acetic acid. There was shown, also, a large cast aluminium pan, weighing about 10½ cwts., and cover for same, weighing about 4 cwts., together with several other large castings, all in pure aluminium, in addition to a large pure aluminium still coil 2 feet 6 inches centre to centre of tube, 13½ coils 15 gauge tubing, 1¼ inches internal diameter with junctions and 6 inches flange plate, all for acetic acid plant. The party also examined several large bronze castings, such as propellers, piston valve bodies, &c., for torpedo boat destroyers. In a separate room were a number of different articles made by various firms from aluminium supplied by the British Aluminium Company, Limited, such as, for instance, cast and spun cooking utensils, kettles, &c., made by the Falkirk Iron Company, Falkirk; Messrs. R. Perry, Son & Co., Wolverhampton; Messrs. Jones Bros. & Co., Limited, Wolverhampton; Messrs. S. J. and E. Fellows, Limited, Wolverhampton; a large number of specimens of aluminium soldering, amongst which were two bicycles made by Mr. H. W. Nield, 89, Blackheath Road, London, S.E., and which, we understand, have been in constant use for about two years without any sign of the soldered joints giving way, also a lot of art metal-work by Messrs. Hardman, Powell & Co., of King Edward's Works, Birmingham; and a good selection of electric light fittings made by the Edison-Swan United Electric Light Company, Limited, for use aboard ship. There were also a large assortment of other ship and cabin fittings, such as door knobs, hinges, rail brackets, hooks, door bolts, finger plates, escutcheons, railway carriage fittings, &c., manufactured by Messrs. J. Cartland & Sons, Messrs. Hoskins & Sewell, Messrs. Wm. McGeoch & Co., all of Birmingham; also a large number of rough castings for general engineering purposes, &c., were on view. These, and the polished fittings, were all made in the British Aluminium Company's No. 6 aluminium alloy, which is admirably suited for such work, and which appears to be very extensively used in the brass and engineering trades throughout the country.

New Electrical Department.—As the Poplar Board of Works contemplates putting in electric plant for the district, Messrs. Hugh Bros., successors to Rundell, Son & Co., wholesale ironmongers, of High Street, Poplar, intend to add an electrical department to their business, both at Poplar and at their Old Street, E.C., branch.

New Premises.—Mr. J. G. Moody has opened premises at 29, Liverpool Road, Birkdale, as an electrical engineer, electroplater, &c.

Mr. Arthur Scott has opened premises at 4, The Parade, Haven Green, Ealing, as an electrical engineer.

Private Telephone Line.—The following tenders were sent in, according to the *Contract Journal*, for the erection of a line of wire, 10¾ miles long, on the estate of Arthur Bignold, Esq., Loch Rosque, Achnasheen:—Cox-Walker's, Edinburgh (accepted). National Telephone Company, Inverness; P. C. Middleton, Inverness; A. J. Forbes, Inverness; Private Wire and Telephone Company, London; Reid Bros., London; E. G. Tillyer, Mottingham, Kent; Lowden Bros., Dundee.

Sargent's Electrical Attachment for Steam Engine Indicators.—This is one of those devices which might be of some use if all engines were single acting and if the engineer spent most of his time in indicating. With double-acting engines there is always a cock to be turned to change the communication with the indicator from the back to the front of the piston, and a man must be there to turn it. When engines with several cylinders are to be indicated, several men must be employed; and when the whistle is blown, their personal error in taking the first indication is small compared with their time error in turning the cock and taking the second indication. Again, if the load be constant, simultaneous diagrams are not required, because all are alike; but if the load be variable, simultaneous diagrams are useless. Under such conditions they ought to follow the revolution of the engine, but even then they would not be of much value, as the antecedent receiver pressures would vitiate the result. The fact is, that with compound and triple engines no cards of any value can be taken unless the load be steady for 15 or 20 seconds; but for scientific purposes the load ought to be constant for a quarter of an hour to eliminate the effect of condensation or superheating by changes of temperature in the metal of the cylinders, valve-chests, and adjacent frame of the engine. We can imagine this invention or device might be of some use in taking accurate tests of a Willans 3-crank triple engine. Then, with 18 indicators fitted with the Sargent electrical attachment, a complete set of diagrams might be simultaneously obtained—that is, if 18 indicators could all be coaxed into proper working order at one and the same moment. Many engineers find it a sufficiently difficult task to get two indicators to fulfil this condition.

South African Electrical News.—The following items of electrical interest are culled from the August issue of the *British and South African Export Gazette*:—Two 110-volt electrical machines, supplied by the Electrical Construction Company, Limited, have been installed at the Geldenhuis Estate gold mine.—A 550-volt motor, for driving a mine pump at the Geldenhuis Estate gold mine, has been installed.—Various tenders for the electric lighting installation at Port Elizabeth, estimated by the Board's London agents, Messrs. Davis & Soper, to involve an expenditure of above £91,000, are being considered by the Electric Lighting Committee.—The Bill empowering a company to lay down an electric tram installation at Howick having passed its second reading in the Natal Legislative Assembly, tenders for the necessary material may be expected to be shortly called for.—A number of the "Little Giant" type of electric drills, manufactured by Messrs. Fraser & Chalmers, Limited, have been supplied to the Princess Estate gold mine.—The following additional electric lighting plant is part of the public works to be undertaken by the Johannesburg Town Council under a loan of £150,000, which it has recently authorised:—Two sets 300 kw. three-phase generators, direct coupled to compound condensing engines, £14,000; two direct coupled exciters of 30 kw., £1,500; switchboards, instruments, &c., £1,000; special step-up transformers, £2,400; transformers and spare coils, £3,000; poles, cables, meters and sundries, £3,500; three motors for arc lamp machines, £750.

Theatre Lighting.—The Metropole Theatre is now fully installed with the electric light. The contractors were Julius Sax and Co., Limited, of Coldharbour Lane, Camberwell, who only had 12 days in which to complete the work. The whole installation is reported to have been run without a single hitch.

Tram Plant for Sale.—The Blackpool Corporation is prepared to sell by private treaty the following plant, now at the tram shed, Blundell Street, Blackpool:—Two Crompton 50-kw. generators with shunt-wound exciters; two Elwell-Parker 4-pole generators with exciters; switchboard instruments; two Marshall 25-H.P. compound stationary engines, and other plant, which is not now required, owing to the transfer of the tramway supply to the electricity works. A large quantity of rubber cable, scrap copper, and 2 and 3 inch C.I. pipes is also offered for sale, and particulars may be found in our "Official Notices" this week. Tenders must be sent in by September 13th.

"Universal Directory of Railway Officials, 1898."—This useful directory, which is compiled from official sources by Mr. S. Richardson Blundstone, the editor of the *Railway Engineer*, has been issued for the current year. As may be gathered from the title, the directory gives the names of the officials of all railway companies in the United Kingdom and all parts of the world. There

are various sections for the different countries, and an alphabetical list of all the names is of considerable service. The book contains particulars of the lengths, gauge, and motive power of each line. The publishing office is at 8, Catherine Street, W.C.

The Welsbach Incandescent Electric Lamp.—The Austrian Incandescent Gas Light Company, of Vienna, has acquired the rights in Dr. Auer's new electric incandescent lamp for Eastern Europe. For this purpose it has increased its capital to 3,500,000 gulden, and has changed its title to the Austrian Incandescent Gas Light and Electrical Company.

ELECTRIC LIGHTING NOTES.

Aberdeen.—The Gas and Electric Lighting Committee of the Aberdeen Town Council met on 2nd inst. to consider a report from Mr. Smith, superintendent, and Mr. Macleod, assistant engineer, regarding the deterioration that has been discovered to have been going on in the insulation in the culverts under the streets since the change in the voltage was introduced, with the result that a great quantity of current has been running to waste. Edinburgh, it seems, says the *Aberdeen Journal*, has had a similar experience, and on the suggestion of the convener of the Committee, Councillor Johnston, Mr Smith and Mr. Macleod proceeded to Edinburgh to learn the measures being taken there to counteract the deterioration. It was ascertained that the Corporation had adopted Crompton & Co.'s patent, which had been found effective. After considering the report, the Committee resolved, before finally agreeing to adopt this method, to consult Prof. Kennedy on the subject, and on obtaining the Professor's approval, to start at once with the installation of the patent at an estimated cost of about £2,000. The convener stated that he had sent a copy of Mr. Smith's report to Mr. Bell, the newly appointed electrical engineer, who had expressed his approval of the course recommended.

Amblecote.—The British Electric Traction Company, Limited, intend to apply for electric lighting powers for Amblecote. No steps will be taken by the Council.

Bath.—A committee of the Council has proposed that tenders be invited of Messrs. Verity and Messrs. Singer for an electrolier for the Old Pump Room, according to the design presented by the surveyor, and that the same firms be asked to submit their own designs and estimates for an electrolier suitable for the room.

Belfast.—At last week's meeting of the Corporation' Councillor Andrews, in moving the adoption of the minutes of the Electric Committee, said during the month two assistant station engineers had been appointed. There was a very satisfactory increase in the rental for electric current in the past quarter. As the Committee were perfectly well aware, the June quarter was the slackest in the whole year, and still the rental showed an increase of about 40 per cent. on the demand of last year. The Committee would soon be coming before them and asking for another grant of money for further machinery.

The Electric Committee is to light Ann Street, Church Lane, Chichester Street, and Castle Street experimentally with incandescent electric lamps.

Birkenhead.—At last week's Council meeting Alderman Bloor, in moving the adoption of the minutes of the Gas, Water, and Electrical Committee, referred to the report of the resident electrical engineer upon the proposed extension of the electric light supply to Bidston and Noctorum. He gave two reasons for the preparation of the report, viz., first, that the residents had memorialised the Committee not once, but several times, and that they had entered into an agreement to use the light if it was brought to them; secondly, the electric light could be extended in the district without any loss, or a very small loss, in the first year, and in subsequent years the profit would be very considerable.—The minutes were passed.

Bournemouth.—Last week the Council accepted tenders for carrying out a scheme for lighting the lower pleasure gardens, pier, and winter gardens by electricity, and it was decided to hold a special meeting to consider the desirability of applying for a provisional order empowering the Corporation to adopt a scheme for lighting the town generally. We understand that the accepted tenders were those of the Brush Electrical Engineering Company (£1,598) and Siemens Bros. & Co. (£1,135).

Buxton.—The electrical arrangements for the stage in the large entertainment room of the Buxton Hydropathic include the latest device for producing moonlight and other effects, and these were recently brought into use. The electrical plant, switchboard, and main cables were installed by Mr. Samuel Hargreaves, electrical engineer, Buxton, and are situated in a building a short distance from the ballroom. There is a 30-B.H.P. Belliss engine, and an E.C.C. dynamo, with an output of 155 amperes, 135 volts, at 500 revolutions. The proprietor is stated to have placed the whole of the electrical installation to be carried out during the next two years in Mr. Hargreaves's hands. For the lighting there are six electroliers, each containing 10 8-C.P. lights.

It is understood that the directors of the Buxton Gardens Company have decided to instal the electric light next season.

Cardiff.—In connection with the recent squabble about the electric lighting plant tenders, the following letter from Mr. Llewelyn B. Atkinson, A.M.I.C.E, to the *Western Mail* is worthy of reproduction:—

"Sir,—In your issue of Wednesday there appeared a report of a meeting of the Electrical Committee called to decide the question of letting a contract for additional plant, as between the contractors who are now supplying a plant and a company of which I am a director. As the report contains allegations made at the meeting, which, I think, if uncontradicted, are likely to damage the latter company, I shall be obliged if you will allow me a few lines. Tenders were invited in June for an electrical lighting plant; a strict specification for which was issued by the borough electrical engineer, though in the last paragraph it stated that an alternative offer for a plant similar to that last supplied would be considered. These tenders were opened, and the borough electrical engineer advised the Committee to accept my company's tender. Councillor Hallett presented an independent report, in which, as reported, he stated that the machine offered was in an experimental stage, was the subject of litigation, and was mechanically defective, and recommended the present contractor's offer, at a higher price to be accepted. These allegations are denied and challenged by my company. It was decided by the Committee to ask other corporations their experience of the work of the two firms, and the further meeting held on Tuesday received the replies, with the result that several other corporations reported delay in completion of contracts by the present contractors, whilst no complaint was made as to my company. In the face, however, of this fact, and of the fact that the official electrical adviser of the Corporation recommended my company's plant, and of the further and important fact that the present contractors are at this moment two years and three months overdue with their present uncompleted contract, on which, according to the contract terms, there are penalties to the value of about £2,000 due to the Corporation, the committee, by the casting vote of the chairman, decided to hand the contract at a higher price to the present contractors. I may add that in a previous contract carried out by my company for the Corporation, the work was completed satisfactorily in less than the specified time, and certificates withheld for some time to enable tests to be made under steam, owing to other arrangements, to which my company were no party, being in arrears. I submit that there appears no inducement held out by the Corporation for prompt and effectual carrying out of contracts, when, after such experiences, the decision arrived at is the outcome. From a broader point of view the whole principle of municipal trading may well be questioned, when methods, which no individual traders would for one moment contemplate, are thus practised with public money, and at a time when ratepayers have been waiting for months to have their lamps connected to the supply, which the non-completion of the last contract has prevented.—I am, &c.,

"Llewelyn B. Atkinson, A.M.I.C.E.

"Cardiff, *August 4th*."

The special Lighting Committee recommended the Cardiff Corporation on Monday, the 8th inst., to accept the tender of Messrs. S. Z. de Ferranti, Limited, for the supply of a steam alternator at a cost of £3,250.—Councillor Frank Fox moved that the paragraph be referred back to the Committee on the ground that the firm named had delayed the delivery of an engine from September, 1896, to December 14th, 1897. He declared that the firm were liable to penalties amounting in the aggregate to £3,152, but understood that the Committee, for some reason or other, had decided not to enforce them. He denied that the delay in delivering the machine arose from the engineers' dispute, saying that while the machine should have been delivered on September 16th, 1896, the labour trouble did not begin until June, 1897.—Councillor Good seconded the proposition.—Replying to Councillor Crossman, the Town Clerk, said there was nothing to prevent the Corporation enforcing the penalty clause. The contract was duly signed and quite in order.—Alderman Carey, chairman of the Committee, said he had no objection to referring back the paragraph.—The motion of Councillor Fox was agreed to, and the paragraph was sent back to the Committee.

The Electric Lighting Committee have resolved that the whole of the men employed by them shall be insured, in view of the Workmen's Compensation Act, up to £3,000, at 10 per cent.

This matter was again before the Corporation on Monday, and the question was referred back to the Committee for further consideration.

Church Lighting.—St. Jude's Church, Southsea, has been fitted with an installation of the electric light. The body of the building is illuminated by means of 10 handsome coronas, each containing six lamps. The north and south galleries are lighted by 12 electroliers, containing three lamps each. The gas fittings in the church and on the altar have been re-lacquered and converted for electrical use, the total number of lights being now 200. The installation was used for the first time on Sunday evening. The work was entrusted to Mr. S. Grossmith, electrical engineer, of Portsea.

Croydon.—The County Council recently considered a report of the Lighting and Electricity Committee, which contained the following paragraphs:—"The committee considered a report from Prof. Kennedy with regard to that portion of the Crystal Palace District Electric Supply Company's undertaking which is within the borough, as also a statement of that company's expenditure on mains, appliances, &c., within the same area. The committee recommend that application be made to the Local Government Board for sanction to a loan to cover the above expenditure, and that if such sanction be granted, it be referred to the Finance Committee to raise the necessary loan. The committee having had before them plans of a site and buildings which can be obtained for a sub-station, situate in Stoney Lane, Upper Norwood, recommend that application be made

to the Local Government Board for sanction to a loan for £850 for the purchase of this site and premises." With the exception of the first paragraph, the report was adopted.

The introduction of the electric light at the old church, Croydon, and St. Matthew's Church, Croydon, is reported to have effected a saving of £20. Mr. Docking has now fitted up the West Croydon Baptist Church with electricity, on the same lines as the churches named above.

Darlington.—Prof. Kennedy has drawn up a scheme for electric lighting, the cost being £22,000. 104 ratepayers have already agreed to take the light at 6d. per unit, and the estimated receipts from them would be £1,411. Outside the area to which the £22,000 applies, there are 120 others who would be consumers. This would necessitate £3,000 for extending cables, &c. The maintenance charges on the £25,000 installation would be £2,450, and the annual income £2,999. The Council has decided to proceed with the larger scheme.

Derby.—Mr. J. E. Stewart, the borough electrical engineer, has resigned that position, and, as stated elsewhere, a new engineer at £350 is to be appointed. Mr. Stewart has asked to be relieved of his duties in five weeks' time, so that he may proceed to his new position, which was stated to be in America. The appointment was subject to three months' notice, but there seems to be a feeling in the Council that he should be released if a new man can be appointed so as to have a week or so with him before he leaves.

Dumfries.—The Town Council is to engage a consulting engineer to prepare a scheme for the supply of electricity to the town.

Dundalk.—A special meeting of the Town Commissioners was held last week to consider the report of the Committee appointed to arrange details of agreement with the Dundalk Electric Tramway Company, Limited, for lighting the town of Dundalk with electricity and for the handing over to them of powers under provisional order for electric lighting. After hearing the report of the Committee it was decided to approve of the draft deed of agreement as submitted, on condition that the tramway company complete the contract of agreement on or before October 5th next.

Dundee.—The Gas Committee has authorised the erection of 27 extra electric lamps in different streets in the city.

Durban.—A Blackpool correspondent who knows the town of Durban and its electrical equipment well, writes:—"May I be allowed to suggest that the sum of £200,000 which is mentioned in your note on the extensions at Durban on page 200 of your last issue, includes not only the sum which it will cost to extend the electric light to the Berea, which is simply the residential part of Durban, but also includes the sum of £114,000 which the Town Council has decided to expend in purchasing the present horse tramways owned by the company. As only a small part of the present permanent way will require re-laying, and as the greater part of the rails which already belong to and are worked by the Corporation are bonded for electric traction, I think that the balance of the above sum will represent the cost of conversion of the system, and also provide for the extension of the lighting area. I believe that I am right in saying that the present extensive public and private lighting scheme was carried out under the advice of Mr. W. H. Preece at a cost of £30,000."

Eccles.—The Electric Lighting Committee reported to the Council last week that Messrs. Hind & Robinson (solicitors) had written that the Council was infringing the patent of their client, Mr. Martin Rucker, in respect to the electricity distributing apparatus. The electrical engineer understood that a similar letter is being sent to various electric lighting contractors in the country.

Failsworth.—The Failsworth Urban District Council met in committee the other night to consider whether to apply for powers for the electric lighting of the district. It was pointed out that the Manchester Corporation some few months ago offered certain terms to the District Council, and that similar terms had been already entered into with some of the out-townships. Councillor James Wilde inquired if any information was available as to the exact cost of obtaining a provisional order, when it was pointed out that the costs depended very much on whether there was any opposition to the application, also as to what expenses the Council would incur in getting expert services. It was ultimately decided that the consideration of the matter be adjourned, and that in the meantime the clerk ascertain from neighbouring district councils what amount of costs were incurred in obtaining their orders.

Farnham.—The District Council will apply for a provisional order.

Garston.—A Local Government Board inquiry will be held shortly *re* the £25,000 municipal electric lighting and refuse destructor works.

Glasgow.—The sixth annual report and balance-sheet of the electricity undertaking, which embrace the year from June 1st, 1897, to May 31st, 1898, have been issued. The Committee state that the gross revenue amounts to £36,360 14s. 10d., and the gross (or working) expenditure to £18,889 18s. 9d. To the latter is added £8,945 1s. 9d. as depreciation written off capital, making £27,835 0s. 6d., and leaving a balance to be carried to profit and loss account of £8,525 14s. 4d. Out of that sum the Committee had to meet the following requirements:—(1) Interest on loans, £4,814 3s. 10d.; (2) sinking fund, £1,537, leaving a balance of £217 10s. 6d., which has been placed to the credit of reserve fund account. In order to maintain the undertaking in its present favourable position the Committee, taking advantage of the prosperous state of the finances, have transferred from revenue to capital, in name of depreciation on machinery and plant at John Street and Waterloo Street stations, and on accumulator battery stations and Mitchell Library plant, in addition to the usual amounts, the sum of £3,243, which is included in the above-mentioned sum of £8,945 1s. 9d. The quantity of electricity sold to private consumers during the past year was 1,885,902 units, being an increase of 46·48 per cent. over the preceding year. The number of private consumers on May 31st, 1898, was 1,437, being an increase of 347 during the year. The quantity of electricity consumed for street lighting has been very little higher than in the preceding year—viz., 228,134 units, as compared with 210,422. There have been only seven additional lamps erected, making a total at present of 119. The number of 8-C.P. lamps applied for (or the equivalent in other devices) was 150,000, being an increase of 42·6 per cent., as compared with the previous year. The number of units consumed per lamp fixed for private consumers had been 15·47, as compared with 12·48 during the previous year. During the year two battery sub-stations, one in Tontine Lane and the other in Claremont Street, had been completed and set in operation, and had been extremely useful in assisting to supply the demand during the few hours of heavy load in the winter evenings. The question of the extension of the supply of electricity had received full attention, and new works and plant were already in course of erection at Port Dundas, while the Pollokshaws Road site was also being prepared as rapidly as possible for the new works and plant which is to be erected there during this year. New mains were being laid in various parts of the city, and the street lighting of the electric tramway route was well advanced.

Godalming.—The Local Government Board has not sanctioned the application of the District Council for a £15,000 loan for electric lighting on account of the opposition to the scheme, and also because there is doubt whether it would become remunerative. The Electric Lighting Committee have considered the matter, but at present make no recommendation, though they by no means abandon the hope of having an installation established in the borough, and are negotiating with the likely consumers. Application will probably be made for an extension of time under the provisional order.

Guildford.—The Paving Committee have had before them tracings showing the extension of the electric lighting mains in High Street, London, Waterden, Clandon, Edgeborough, and Epsom Roads, and have asked the company to substitute plans of a more permanent character.

Halesowen.—The District Council will apply for a provisional order.

Hampstead.—On Thursday last week at the Vestry meeting the Lighting Committee reported that the number of units of electricity sold by the Vestry for the past midsummer quarter was 134,231, as against 83,719 for the corresponding quarter of last year, thus showing an increase of over 50 per cent. It will shortly be necessary to extend their plant. The Committee also reported that they had considered the letter, dated July 14th, from Messrs Hind & Robinson, solicitors for Mr. Martin D. Rucker, of 28, Ely Place, E.C., as the proprietor of certain letters patent in respect of an invention for improvements in distributing electricity and apparatus therefor, stating that the Vestry are now, and for some time past have been infringing such letters patent, and that they were instructed to require damages and an undertaking to cease to use the invention until a license be obtained; that it appeared that Messrs. Hind & Robinson had made similar claims on many other electric lighting undertakers, and had commenced legal proceedings against the London Electric Supply Corporation, Limited, and that the Committee had instructed the vestry clerk and electrical engineer to attend a meeting called by such corporation on Wednesday, July 27th, also the meeting of the Municipal Electrical Association on Friday, August 5th, on the subject, and recommended that the Vestry do join with other corporations and companies in defending the action commenced against the London Electric Supply Corporation, Limited, and that the vestry clerk be empowered to take all necessary steps in the matter. After a long debate the recommendation was carried.

Hapton.—The electric lighting of the township has been placed in the hands of Messrs. Simpson Bros., a local firm, who quoted £118 odd for the period from September 1st to April 30th next year. Messrs. Calvert, of Manchester, also quoted (£400).

Hartlepool.—The Electric Power Distribution Company has asked for a conference as to the electric lighting of the borough, but the Council has replied that at present the Corporation could make no promise; also that when the provisional order is obtained, the Council would consider the best means of its application to the district.

Hastings.—The report of Prof. Hy. Robinson to the Corporation on the property of the Hastings Electric Light Company is stated to contain the following paragraph:—"It is quite clear to me from a general view of the facts that the present ordinary share capital would have to be largely written off, so that further capital might be raised to enable the necessary extensions to be carried out, and the undertaking made profitable to the shareholders. Inasmuch as the Corporation cannot at present acquire the undertaking except by a voluntary arrangement with the company, it remains to be decided whether the amount named in the agreement of July 23rd, 1897, namely, £54,200, includes too large a sum for the goodwill. I am of opinion that it does, and consider that £40,000 more nearly represents a fair value."

A copy of Prof. Kennedy's report has been placed before the Local Government Board and the solicitors to the company. The Council

last week approved of this course. The report was sent at the Local Government Board's request, and the Town Clerk stated that the Council had agreed to buy the works for £58,000, subject to the Board's sanction. If the Board declined to sanction the borrowing of £58,000, the contract fell to the ground, and the Council would be free as well as the company.

Hull.—At the last meeting of the City Council, Dr. Holder, on the Electric Light Committee's minutes, asked why 20 danger boards were required, as when he pointed out some time ago that the high voltage system was dangerous, he was hounded in many of the electrical journals, instigated by—he did not know who. He had been told that all his fears were absurd, but the fact remained that some men had been killed by touching a similar electric main, and that the Hull Corporation were being asked to provide "danger" boards. Mr. Skinner said the answer was very simple. The boards were not to warn the public generally, or even the workmen in the streets. They were simply to attach to the different switches in the station, to make the men more careful and cautious. They did not attach to the high tension main in the streets.

Islington.—The Works Committee submitted to the Vestry on Friday an estimate of the expenditure for the half-year ending March, 1899, and recommended that £11,674 be raised for public lighting by a rate of 1½d. in the £. On the motion for the adoption of the recommendation, Mr. James again raised the question as to the financial position of the electric light works. He stated that in reality the electric light undertaking did not yield a farthing profit to the ratepayers. It was true that the balance-sheet showed an apparent profit, but who was paying for it? It was being paid for by the excessive sum charged for the public arc lighting. In one of the metropolitan parishes, St. James's, the price ranged from £17 to £18 per lamp per annum, whereas in Islington they paid no less than £40 per lamp annually. It would be necessary for the Electric Lighting Committee to reduce the price, and he drew attention to the matter in order that the fact might not be overlooked. In reply to these statements, Mr. Fearnhead stated that Mr. James was partly right and partly wrong. The sum mentioned in the case of St. James's and Pall Mall was not quite correct. The charge for public arc lighting in Islington included painting of the lamp columns and carbon renewals, but there was no doubt the Electric Lighting Committee would reduce the cost. The recommendation was then adopted. A reference to the above-mentioned estimates shows that there are now 194 public arc lamps, and it is estimated by the end of the half-year this number will be increased to 327 lamps. The estimated expenditure on the supply of current to the public lamps during the half-year is £4,070.

Kingswood.—Messrs. Parfitt & Sons' solicitors wrote to the Council some days ago, asking them to settle a date for taking over the electric lighting undertaking. The matter was referred to the Electric Lighting Committee. It appears that there was no time mentioned in the contract.

Lambeth.—The Vestry Clerk reported at the last meeting that in reply to the application made to the Board of Trade to hold an inquiry into the circumstances attending the transfer of the electric lighting provisional order from the Vestry to Mr. Sax, the Board stated that they did not appear to have any power to make such an inquiry. It was accordingly resolved to approach the Local Government Board asking that Department to hold an inquiry into the matter.

Lincoln.—The laying of the electric light mains is proceeding. At the City Council recently, it was complained that other than local labour was being employed, but it was pointed out in reply that it was of first importance to have the work done by those who knew the business, local labour being a secondary consideration compared with good work.

The Guildhall is to be lighted electrically. The Council last week approved of the Electric Lighting Committee's instructions to Mr. Vesey Brown, the electrical engineer, to invite offers from the National Free Wiring Company for providing the wiring and fittings, &c., for the purpose.

Longton.—The Council will not sanction the application of the Potteries Electric Traction Company for an electric lighting order, but will apply for one itself.

Lowestoft.—Recently the Town Council applied for a provisional order for electric lighting, it being the intention to establish electricity works in conjunction with a Horsfall destructor which it has been decided to erect. The order was granted, and has now been confirmed. Several proposals have been made to the Council with regard to the working of the order, amongst them from the Municipal Electricity Supply Company and Crompton & Co., Limited. The Town Council, however, at a meeting held on Monday decided to put the order in operation itself, and it was referred to a Committee to obtain a scheme for lighting the town with electricity, with details, estimates, and tenders, and to report thereon to the Council, with a view to an application being made to the Local Government Board for sanction to a loan for carrying out the work.

Lye and Wollescote.—Mr. J. A. Lycett, manager of the Stourbridge, Dudley, and District Electric Traction Company, is to attend before the Lye and Wollescote Urban Council to explain the position of his company with regard to electric lighting, &c.

Maidenhead.—The Town Council is asking Messrs. Burstall & Monkhouse whether they would act as consulting engineers for the preparation of an electric lighting scheme.

Manchester.—Through the generosity of Mr. Reuben Spencer (who presented the sum of £500 for the purpose) the Manchester Museum is now lighted by electricity.

Newport.—The *South Wales Argus* says that a complete system of electric lighting is in course of construction at the Alexandra Docks. The scheme is intended to supersede the present system of gas illumination. The generating plant will be fixed in the new engine house, and will consist of one 120-H.P. vertical compound engine, coupled direct to an alternator. The current will be generated at 2,000 volts, and will be distributed by cables laid underground to transformers placed at various parts of the dock, reducing the pressure to 110 volts. From the transformers the current will be carried to various incandescent and arc lamps scattered over the whole area of the docks and railway. About 40 arc and 400 incandescent lamps are being installed. The roadways, coal-tips, cranes, locks, and piers will all be illuminated by arc lamps, and the whole of the workshops, buildings, &c., by incandescent lamps. The contract has been secured by Messrs. R. Alger & Sons, engineers, Newport, in competition with London firms.

At a recent meeting of the Electricity Committee the office manager submitted his report for the quarter ended June 30th, 1898, as follows:—

—	Total No. of consumers to date.	Total number of lights connected (including arcs) equivalent to 8 C.P. lamps.	Units to be paid for during the quarter (including arcs).	Cost of generation and distribution per unit.	Total costs (not including sinking fund and interest).	Total revenue (including meter rents).
			Inc. 25,053 Arc 17,644		£ s. d.	£ s. d.
	217	18,453	42,697	4·78d.	851 13 6	863 4 5
Corresponding period last year	141	13,101	Inc. 15,650 Arc 16,982 32,632	4·44d.	603 15 1	647 14 6

He also submitted his usual monthly report, showing that the number of lights now connected is equivalent to 18,497, in addition to which there are on order 473, making a total of 18,970 lights. The main is to be extended from the end of Commercial Road to the Ship Hotel. The office manager having suggested that an exhibition of electric light fittings and appliances should be held in the Assembly Room in the autumn, it was resolved that the consideration of the matter be deferred for the present. Reference having been made to the question of discontinuing the minimum charge of 13s. 4d., the works manager reported that he had sent notices to all consumers, offering to have their switches removed if they wished to avoid the minimum charge during the two summer quarters. It was resolved that after the quarter ending September 30th next, the minimum charge be not made. The Town Clerk read letters from Messrs. Hind & Robinson, solicitors, London, stating that they had been instructed by Mr. Martin Rucker to give notice that he intended to claim damages from the Corporation for the infringement of a certain patent in distributing electricity by alternating currents, which he had purchased from Messrs. Zipernowsky & Deri. The patent has about 18 months to run, and it has been recently bought by Mr. Rucker, and similar notices have been served upon all the high tension alternating current supply stations. A letter from the London Electric Supply Corporation, stating that they had decided to contest the matter, and asking that representatives of corporations and companies interested should be appointed to meet in London to consider ways and means, was read. It was resolved that the consulting engineer be requested to attend the meeting on behalf of Newport, and that the Council be asked to authorise the committee to co-operate with other bodies in opposition, and to contribute their proper proportion towards the law expenses.

Newport, Isle of Wight.—At the last meeting of the Town Council the Finance Committee reported that they had decided to give notice to the Edmundson Electricity Corporation and Messrs. Mackey that their applications for powers to light the borough with electricity would be opposed by the Corporation.

Paddington.—The Guardians will have the new casual ward wired for electric lighting. The proposal to light certain portions of the workhouse by electricity is still under consideration.

Poplar.—The District Board of Works has received a letter from the London and Provincial Brush Electric Lighting Company, stating that "in future their charge would be reduced to 3d. per unit."

Portsmouth.—The Electric Lighting Committee of the Town Council have had under consideration the threatened action of Mr. Rucker for alleged infringement by the Corporation of an electrical patent purchased by him from the inventor. It was decided that combination with other parties for the purposes of defence would be desirable.

Provisional Orders.—The Bills for the confirmation of the Burslem, Crewe, Stoke-on-Trent provisional electric lighting orders, also that of the Midland Electric Corporation for Power Distribution, came before the Chairman of Ways and Means of the House of Commons as unopposed measures some days ago, and the preamble having been proved in each case, the Bills were allowed to proceed.

The Bill promoted by the Chorley Corporation for obtaining a

provisional order to supply electricity has passed a committee of the House of Lords, and the preamble has been declared proved. Chorley has 25,000 inhabitants.

Reading.—On the 22nd ult. the Highways and Lighting Committee examined and passed a large number of plans, and forwarded to the Board of Trade their "observations" on an appeal to that Department by the Reading Electric Supply Company against the decision of the Council in the matter of changing the standard pressure.

Ryde.—Ratepayers and others are signing a petition for presentation to the Mayor, asking him to call a public meeting to decide whether the terms of the Electric Light and Power Company, Limited, should be accepted, or whether the Council should do the work.

Sheffield.—The large Montgomery Hall, Sheffield, and the rooms attached, are to be lighted with the electric light. The contract for the wiring and fittings has been secured by Messrs. Ernest G. Denner & Co., Sheffield. The current will be taken from the Corporation mains. The above firm have also a number of power installations on hand.

South Shields.—The demand for the light is still increasing, and on Saturday, 30th ult., the heaviest load was recorded. The second engine is about ready for delivery, and will be working before the dark nights set in. There will then be ample means to meet any demands during the coming winter. The Electric Lighting Committee has decided to go in for a further extension of the plant at the station, and the Town Clerk is to apply to the Local Government Board for sanction to the borrowing of £20,000 for the purpose.

St. Anne's-on-the-Sea.—The Council is to meet at an early date for the purpose of adopting a scheme for having the town lighted by electricity, the Royal assent having been given to the provisional order.

St. Helens.—Last week the Council decided, on the Gas Committee's recommendation, to erect arc lamps to light with electricity Raven Street, Church Street, Liverpool Road, Westfield Street, Ormskirk Street, Cotham Street, Corporation Street, and Shaw Street. Alderman J. C. Gamble condemned the expenditure connected with this, which would be about £300 a year more than gas.—Alderman Cook (chairman of the Gas Committee) said it would cost £258 more to light those streets with electricity than with gas, but they would have 10 times more light. The idea was to have the main streets better lighted, and especially those streets where the trams ran. St. Helens had had the reputation of being one of the worst lighted towns in the district, and he thought, perhaps, it was deserved.—The minutes were passed.

Stretford.—The Electric Lighting and Tramways Sub-committee recommended that the Council should themselves take up their provisional order of 1897, authorising the supply of electricity for lighting and haulage purposes throughout the district, and that with this object, a consulting resident engineer be at once appointed at a salary not exceeding £300 per annum; also that a sub-committee be empowered to visit such districts as may be thought desirable for the purpose of obtaining sufficient data relative to electric undertakings, to enable the committee to arrive at a thoroughly efficient and modern scheme. The General Purposes Committee deferred the matter for a month.

Sutton Coldfield.—The District Council will apply for electric lighting powers.

Teignmouth.—The District Council will consider whether to apply for a provisional order.

Tunbridge Wells.—The Town Council had a discussion *re* the lighting of the borough last week. Proposed reductions in the charges to consumers were considered, and the matter was referred back to the Lighting Committee.

Ventnor.—At a meeting of the District Council last week, a letter was read from the Edmundson Electricity Corporation acknowledging the receipt of a plan showing the positions of the street lamps, and intimating that they were preparing a draft agreement.

Walsall.—At a meeting of the Walsall Town Council on Monday the General Purposes Committee reported that the Board of Trade had notified that Walsall had been omitted from the area of supply of the Midland Electric Power and Lighting Provisional Order, as requested by the Council, thus preventing any interference with the rights of the Corporation under their electric lighting order.

Whitechapel.—We reproduce the following paragraph from the *East London Advertiser* without comment:—"We learn that the electric lighting question at Whitechapel has not been allowed to slumber. A meeting of the committee has been held, and it is probable that an effort will be made to induce Mr. Wright, the electrical engineer to the Brighton Corporation, who possesses the most successful municipal installation throughout the kingdom, to give part of his time to carrying out the Whitechapel installation at a salary approaching £600 per annum."

Whitstable-on-Sea.—The Urban Council will oppose all comers who seek electric lighting powers, it being the opinion that the supply should be municipal.

Willesden.—At a recent District Council meeting the engineer called attention to the existence of an electric light generating station established at the rear of houses in Chichele Road and Anson Road, by Mr. A. McBain, for the supply of electric light to houses erected by him. As such light was supplied without interference with roads under the jurisdiction of the Council, no action was taken in the matter.

The Unopposed Bill Committee of the House of Commons on Friday last passed a Bill which confirms a provisional order, granted by the Board of Trade, authorising the Urban District Council of Willesden to supply electricity throughout their district. This order has now been confirmed by both Houses.

Wimbledon.—On 3rd inst. a Local Government Board inquiry was held as to the establishment of a dust destructor at the electric lighting works, similar to that at Leyton, for erecting which a loan of £5,000 is to be raised. It was argued that to burn the sewage sludge instead of putting it on the land, as at present, would be a waste; but the advocates of the scheme pointed out that £400 a year would be saved for coal to drive the dynamos.

Messrs. Parsons & Townsend have been wiring the new stables of the District Council in Queen's Road, and as soon as the central station is complete, and the cables laid, the light will be switched on. It is not expected, however, that everything will be ready till early in 1899.

Winchester.—The Winchester Electric Light and Power Company, Limited, have received applications for 2,145 shares of £5 each, which is quite sufficient for their present needs.

Wood Green.—The District Council will oppose the applications of the Tottenham and Edmonton Gas Company and three electrical companies for electric lighting provisional orders.

Worthing.—The Town Council last week approved of the recommendation of the Electric Lighting Committee that Messrs. Burstall & Monkhouse prepare a complete electric lighting scheme, and attend the Local Government Board inquiry, and afterwards supervise the carrying out of the undertaking if sanctioned. An agreement embodying terms has been entered into.

Wycombe.—The shaft at the electricity works has been erected. A trial run of the works was to be made last Friday, and it was hoped that the town would be lighted this week.

ELECTRIC TRACTION AND MOTIVE POWER NOTES.

Audenshaw.—At a recent meeting of the Tramways Committee representatives of the British Electric Traction Company attended, and set forth the advantages which the company offered. The question for the Audenshaw district to consider was whether the company could offer facilities and advantages greater to the district at large than Manchester, by providing a line connecting Ashton with Manchester. The company suggested that the Audenshaw Council should purchase the line within the district, and the company would then take a lease of the line for a term of years, and equip same and connect it with the other existing lines. The Committee adjourned the consideration of the suggestions and terms to a future meeting.

Barking.—The electrical engineer has pointed out that if the Council proceeded with the light railway scheme, the whole of the space in the electric lighting station would be at once taken up; and that it would be cheaper to extend the building now than later on. The surveyor is to report on the matter. The Lighting Committee is to obtain terms from owners upon which they are willing to sell land required for the light railway scheme. The Committee has resolved that the electrical engineer be paid 4 per cent. on the amount of the contract for the electrical portion of the railway work, if carried out by the Council; that if not so carried out, he be paid £100, to include all charges and out-of-pocket expenses.

Birkdale.—The District Council last week referred an invitation from the Southport Corporation to a conference on electric traction for the tramways to the Highways Committee.

Blackpool.—At the last Council meeting the minutes of the Electric Lighting and Tramways Committees, providing for the borough surveyor to lay tramways in Queen's Square and Queen Street forthwith, with an improvement as regarded the curves, and with the addition of a cross-over in Queen's Square, were confirmed. The Committee's minutes for statutory powers for a provisional order in the next session of Parliament for the laying of a double line of tramways from Talbot Square to the Gynn, to be laid near the westerly footway, were also confirmed.

Buenos Ayres.—A financial daily says that on the 29th ult. a further 3½ miles of the system belonging to La Capital Tramways Company, Limited, was successfully inaugurated. This section has been converted from horse traction to electricity, and connects, *viâ* San Juan and Comercio, the section of 9½ miles from Entre Rios to Flores, opened in December last, with Paseo Colon, one of the main streets of the city.

Cambridge.—The Cambridge Tramways Company is intending to shortly equip the lines for electric traction, and is in consequence asking for an extension of its lease.

(*Continued on page* 243.)

THE MIDDLESBROUGH, STOCKTON, AND THORNABY ELECTRIC TRAMWAYS.

The most important electric tramway that has yet been opened in this country is the system which connects Stockton with Middlesbrough. It is important because it is the first instance of the complete conversion of horse and steam lines into electric. There have been no tentative experiments to demonstrate the suitability or otherwise of electrical methods; the management became convinced of the merits of the system and adopted it wholly. In this system two features stand out prominently: the remarkable despatch with which the lines have been executed, and the special nature of the plant employed. We shall dilate at greater length upon these; in the meantime, it is interesting to call attention to the previous tramways that have existed in the district. It is hardly necessary to say that the two great centres of industry—Stockton and Middlesbrough—are a few miles apart, and so nearly are the two places allied in industrial and other matters, that there is a never-ceasing intercourse between them; until the initiation of the present tramways, however, somewhat scanty means of communication existed. The railway service was too infrequent, and a steamer service inaugurated of late years, though extremely popular, had drawbacks arising from the tidal nature of the channel and the liability of the traffic to be stopped at and about low water by large steamers blocking the fairway.

Street View, Middlesbrough.

The first tramways in Middlesbrough were constructed under powers obtained in 1873, and extended in 1875. The lines were constructed on the gauge of 4 feet 8½ inches, and were, from the first, worked by horse haulage. In August, 1878, the property in these tramways was acquired by the Imperial Tramways Company.

The tramways in Stockton were constructed under powers obtained in 1880, 1884, and 1889, and latterly consisted of 3¼ miles of single and double line on the gauge of 4 feet, connecting the townships of Norton at one end of Stockton, and Thornaby on the other side of the Tees.

In the method of constructing the permanent way and buildings, the Imperial Tramways Company has established a standard both as regards character, material, and time, which may smooth the way for further enterprises of the same kind in this country. The Royal assent was given to the Act authorising the work on August 5th, 1897. Ground was broken for the new line at the Norton terminus on September 1st last, and so rapidly was the work carried on that the entire permanent way of 15 miles of track was completed in less than six months. This reduced the interruption of the general traffic on the streets and roads to a minimum, and actually within 18 months of the completion of the negotiations with the local authorities, and 10 months of breaking ground, the lines have been opened in full working order.

The tramways have been laid out, constructed, and put into operation, under the personal supervision of Mr. J. Clifton Robinson, C.E., managing director and engineer to the company, and his practical staff. The Imperial Tramways Company, it is interesting to mention, is directed by Mr. George White, of Bristol, Mr. Hugh C. Godfray, Mr. Clifton Robinson, and Mr. Samuel White, secretary, and these gentlemen, it is hardly necessary to say, have had experience in this country of electrical methods through their connection with the Bristol and Dublin pioneer tramway systems.

The extent and location of the lines are shown by the map. Starting from Norton Green—from a simple termination of the rails, and not from the triangular or splayed lines used by the old tramway engines and cars—the principal line proceeds due south to the bottom of High Street, Stockton, then, bending round by Bridge Road, it crosses Victoria Bridge, and passing through Thornaby, proceeds north-east and east to and through Middlesbrough, then south-eastward by Ormesby Road to the termination of the main line at the head of that road. This line of 6½ miles, is double throughout the greater part of its length, while between Thornaby and Newport for a distance of over one mile, where a single line is laid, the "passing places" are so numerous, that for all practical traffic purposes the tracks

are double throughout. In Middlesbrough, a second through line, about 2 miles in extent, connects Clarence Ferry and Linthorpe. A short line in Marton Road will connect the Ormesby and Clarence Ferry tramways, and in Parliament Road another cross line of 5 furlongs is introduced, connecting the two main lines at the south-east of Middlesbrough. A total track length of 15 miles has been completed and brought into operation, and lines authorised and proposed will add 20 miles of additional tramways to the system.

The method of construction was, so far as the permanent way is concerned, the same throughout, and the rail bonding and electric connections are necessarily uniform. The tracks are laid on a 3 feet 6 inches gauge and paved with whinstone and granite setts from Norton to Thornaby, and with scoria blocks throughout Middlesbrough.

The progress of the work was viewed with great interest by the community from first to last, and when five or six gangs of 70 to 100 men each were to be seen busy at various points, the scene was ever an animated one. The first process was to remove the old tramway and to clear out to the required depth of 14 inches the breadth of roadway to be used. The road bed extends to 18 inches on each side beyond the outside rails. Following in every case the excavating squad came the concreters, who laid down a solid foundation of 6 inches depth of Portland cement concrete, in which six parts selected grey Cleveland slag and sand to one part Portland cement were used. The concrete, laid to level, was then ready for the platelayers, who proceeded to the actual track laying. The steel rails, in 30 to 36 feet lengths, are 6-inch girders, 92½ lbs. to the lineal yard. At every 10 feet the rails are tied to gauge by steel bars, and the joints are secured by specially designed fish plates, the plates being countersunk for six square taper-head bolts. The rail-ends are longitudinally bonded with double copper bonds, carefully fitted by hydraulic pressure in holes clean drilled in each rail, and at intervals of 120 feet the tracks are further cross-connected by copper bonds. When the rails had been thus laid and adjusted, the whole surface extending over the tramway area was floated in cement and, on a 1-inch bed of sand, the paviours then proceeded to lay in and finish off the paved surface with granite, whinstone, or scoria setts, closely grouted with cement, and top-dressed with sand. As each section was finished a short interval was allowed to permit the concrete and cement to consolidate, and the roadway was then ready for the resumption of ordinary traffic. The interruption was thus reduced to a minimum on each individual section. The gradients generally are easy and fully within the power of electric traction, but some of them, as, for example, one in the east end of Thornaby, are such as would render horse or steam haulage exceedingly difficult. This gradient (1 in 18) occurs near Mandale Road.

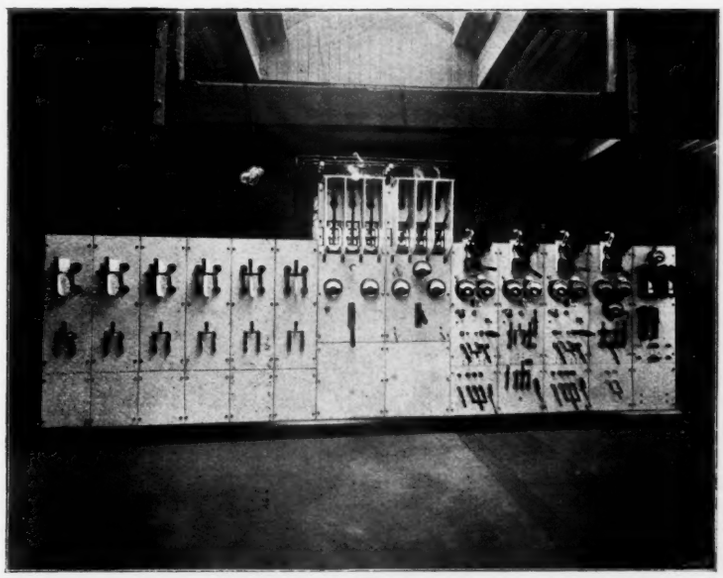
The central power station (which is shown in the various illustrations) is conveniently situated close to Victoria Bridge, Bride Road, Stockton-on-Tees, the original site having been greatly extended so as to secure a frontage to the River Tees. A wharf has been erected with a river frontage of 200 feet—the full length of the property—at which coal and other stores will be landed.

Main Switchboard at Generating Station.

The wharf has been constructed on substantial lines, with heavy pitch-pine piles and decking, the river bank slope being pitched with stone. An electric crane on the wharf is used for discharging coal from the vessels, the coal being first put into a hopper, where it is weighed in 3-ton lots. After weighing it is automatically hoisted and discharged by an elevator into the storage bunkers, from which it is fed by gravity into the hoppers of the mechanical stokers, and so into the furnaces. About the centre of the wharf a cast-iron case sump with cut-off valves has been laid down for the efficient supplying of the condensing plant.

The extensive buildings, designed by Mr. Clifton Robinson, provide administration offices as well as accommodation for the engines and boilers and principal electric machinery,

with space for the installation of additional units of power when these are required. The walls of the engine and boiler house are of brick, faced on the outside with red pressed brick of the best quality, while the internal face is of white glazed brick, also of the best quality. The interior is divided into panels by plinths and string courses in blue glazed brick. In the engine room the wall is also divided into arched panels, over which a stone cornice, running the full length of room, carries a 10-ton overhead travelling crane. The roofs are open and consist of iron principals with varnished and grooved boarding, the outside being covered with blue Welsh slates.



Sub-Station Switchboard.

The engine room has a basement below the ground floor, and this floor is supported upon iron girders with boiler plates between, concreted to floor level, and finished with artistic marble mosaic tiles, with borders in keeping. The condensing and pumping plant is arranged on the basement floor, and all steam condenser, suction, and other pipes and connections being also carried below the floor line a clear space is thus obtained around the engines and generators. The engine foundations, of which there are three, are built in solid concrete from the basement floor level, making a thoroughly massive and substantial job. The engine room measures 110 feet × 52 feet, and has a clear space of 36 feet from the floor to the tie bars of the roof principals. The boiler room is 78 feet × 48½ feet, and is of the same height as the engine room. Here there are provided three Babcock and Wilcox water-tube boilers, each having a heat-

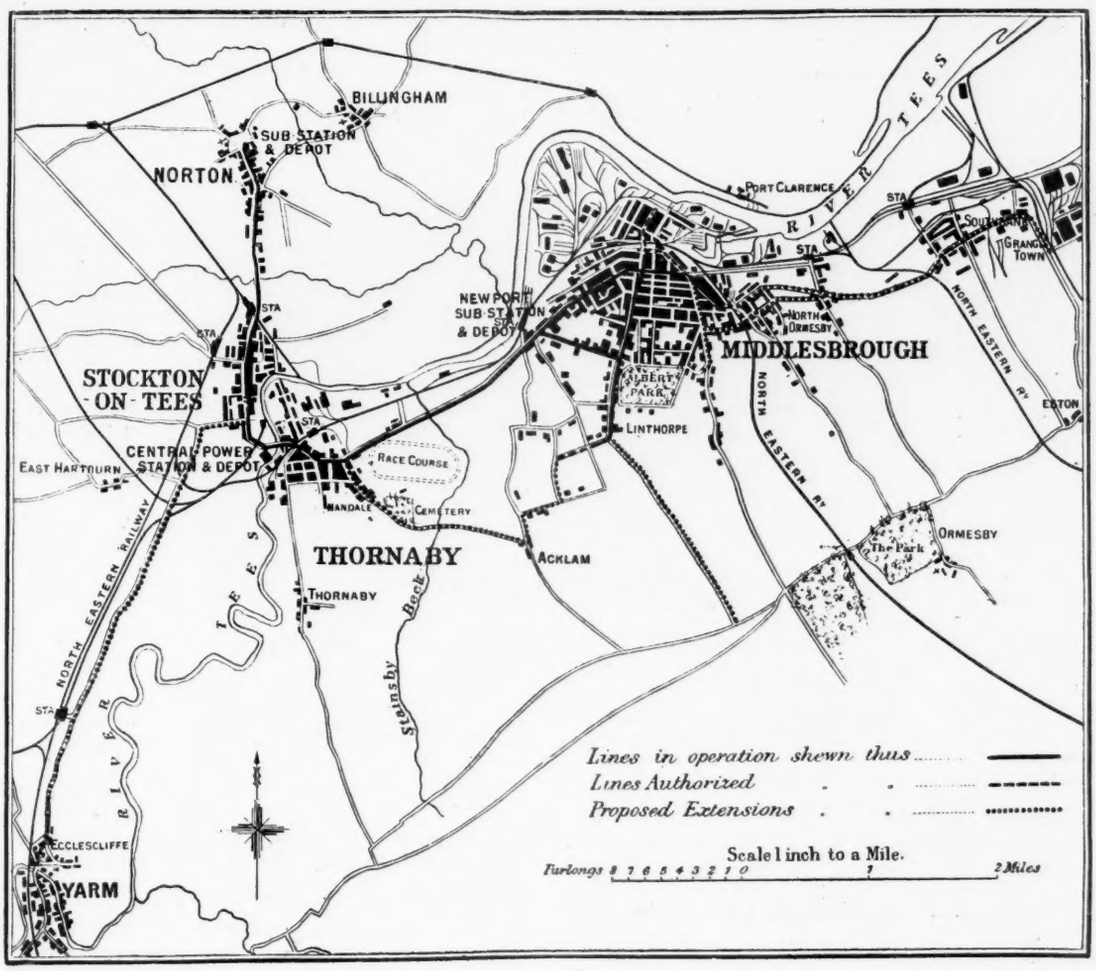
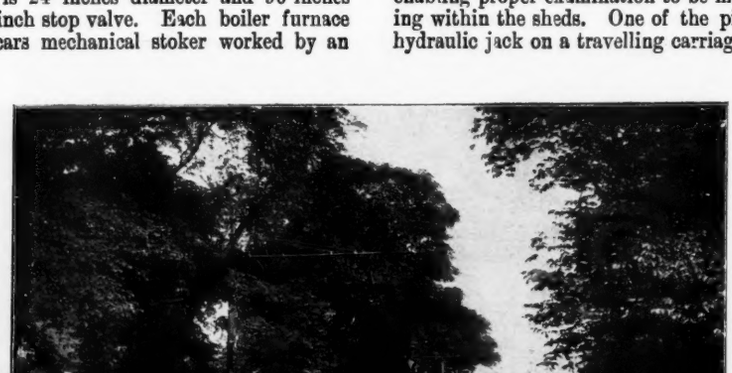


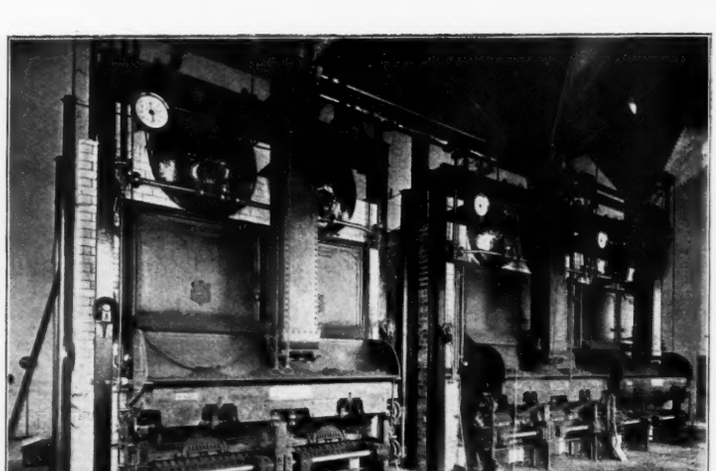
Diagram of Route.

ing surface of 3,580 square feet, and being capable of evaporating 12,000 lbs. of water per hour. The steam and water drums are 22 inches diameter and 23 feet 7 inches long; the cross drum is 24 inches diameter and 90 inches long and carries an 8-inch stop valve. Each boiler furnace is equipped with a Vicars mechanical stoker worked by an electric motor. The coal, as already described, is taken direct from barges on the River Tees by an electric hoist provided with an automatic grab, and is discharged into a receiving hopper where it is weighed, being then taken by a conveyer, and carried to the storage bunkers inside the station. These bunkers are of steel, supported on steel columns, and have a total capacity of about 300 tons. The conveyer is capable of handling 20 tons per hour.



A Portion of the Line at Norton.

The smoke stack, which is 132 feet in height and 7 feet diameter at the top, is octagonal in section and is built of best pressed brick and lined with fire brick. In the flue leading to it is placed a Green's economiser of 240 tubes. The boilers supply steam to three Reynolds-Corliss horizontal cross compound condensing engines of 400 H.P. each, made by the Edw. P. Allis Company, Milwaukee, U.S.A. The high pressure cylinder is 16 inches in diameter, and the low pressure 32 inches in diameter, the stroke being 36 inches. Each engine runs at 94 revolutions per minute, and is directly coupled to a 300 kw. three-phase generator. A surface condenser, having combined air and circulating pumps, is provided for each engine, and a supplementary atmospheric exhaust pipe is provided, into which the exhaust from any engine can be turned in case of failure or repair of the condensers. Water is drawn from the River Tees for operating the condensers, and the boiler feed-pumps, of which there are two, have steam cylinders 7½ inches diameter × 6 inches stroke and pump cylinders 4¼ inches diameter. The suction pipe is 14 inches and the discharge 13 inches diameter.



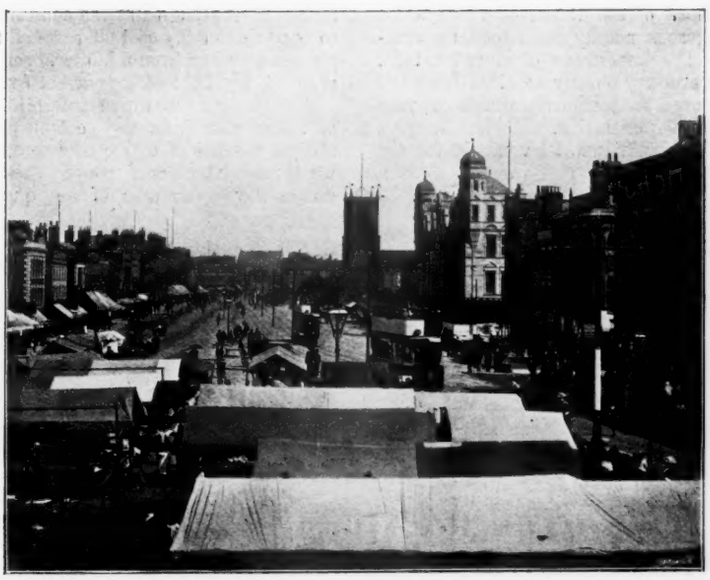
View of Boilers, showing Hoppers and Mechanical Stokers.

Extensive new car sheds have been erected on part of the site formerly occupied as a steam tramway depôt by the old Stockton and Darlington Company, the roofs being of iron, supported on iron columns. Pits are excavated the full length of each car track (of which there are seven), thus enabling proper examination to be made of every car standing within the sheds. One of the pits is provided with a hydraulic jack on a travelling carriage, facilitating the ready manipulation of the heavier parts of the equipment, and capable of lowering a truck bodily. All these buildings, as well as the car pits, are electrically lighted.

Double tracks, with the necessary points and crossings, have been laid throughout the sheds, and the floor is concreted and finished to an even surface. Provision has been made for drainage on a model plan, with manholes, by which any part may be examined and cleaned without disturbing the flooring. Adjoining the sheds is a building in red brick, white faced internally, for the accumulators. This gives accommodation for a battery of 260 cells, capable of discharging current, by which the engine and boiler rooms, sheds, repairing shops and offices will be lighted electrically when the engines are stopped, also providing power to start running each morning, and for line inspection purposes.

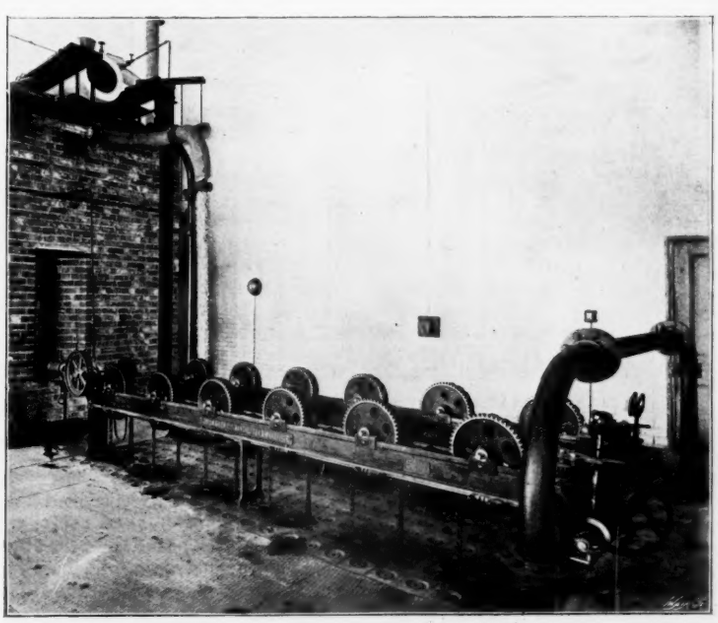
We need hardly say that the principal feature of the system is the adoption of the three-phase generators, which are placed at the main generating station, and from thence transmit three-phase current to a sub-station at Newport, a distance of 2½ miles from the central station. As we have already said, there are three three-phase generators, each of 300 kw. capacity, having 32 poles, and running at 94 revolutions per minute, giving 2,500 volts at a frequency of 25 cycles per second. The magnetic frame is of cast-iron, with laminated sheet-iron pole-pieces bolted together and cast into the yoke. The field coils are wound on sheet-iron spools with brass flanges, and are insulated from the sheet-iron with paper, and from the flanges by wooden rings capable of standing a puncture test of 5,000 volts. The armature core is built of sheet-iron laminations ·014 inch thick, with rectangular slots punched in their periphery to

receive the winding. The punchings are fastened to the spider by dovetailed projections on their inner circumference, which fit into corresponding slots on the outer circumference of the armature spider. Ventilating spaces are arranged at intervals between the laminations to allow of a free circulation of air in immediate contact with the core and winding. The armature spider is of cast-iron in one piece, consisting of a hub with outwardly projecting spokes supporting the punchings. The hub is pressed on and keyed to the engine shaft. The armature winding consists of 48 coils, all mounted on formers, and insulated to stand 8,000 volts. The portions of the coils which project beyond the core on each side are arranged in two layers so as to furnish ample space for insulation. This arrangement also renders it possible to remove one half of the coils without disturbing any of the rest. Any of the others can be removed by taking out the two adjacent coils. The coils are held in the slots by means of wooden wedges driven into recesses at the top of the slots. The weight of the armature is about 14,500 lbs. and the total weight of the machine about 45,000 lbs.



The Tramway in Market Place, Stockton.

The fields are excited from the 500-volt bus bars. To supply light when the machinery is stopped, and to start the dynamos in the morning, the battery of accumulators has, as already stated, been provided. These are by the Tudor Company, and consist of 260 cells, with a discharge rate of 48 to 70 amperes; the capacity, at the lower discharge rate, being 240 ampere-hours. For charging these accumulators, a booster is connected in series with the 500-volt bus bars. This booster consists of a rotary converter fed from step-down transformers of special design. Each transformer has the primary and secondary separated, so as to give the effect of a considerable re-actance, this arrangement giving a large range of voltage on the rotary converter to provide for the alteration in the charging volts required by the cells. The switchboards are shown in the illustrations.



View of Economisers.

The rotary converters employed are practically new to this country. They consist essentially of direct current generators, to the armature winding of which connections are made at suitable points to a set of three collector rings on the end of the shaft opposite that occupied by the commutator. The three-phase current is led into these collector rings, and the machine is run at the current speed for 25 cycles. The same winding thus serves both for the alternating current led into the machine and for the direct current taken out.

The magnetic frames of these machines are of cast-steel of the ring type in two parts bolted together with the joints accurately faced to minimise the magnetic reluctance of the joints. The poles are of steel laminations bolted to the yoke. They have projecting pole-pieces to increase cross section at pole face, so as to obtain proper magnetic density to ensure good performance of the commutator. The armature winding consists of copper bars shaped on a former, and insulated with oiled cotton fabric before being placed in the slots. The parts of the winding projecting beyond the core are supported on cylindrical extensions of the end rings and fastened down on them with brass binding wire. The two bars forming two sides of the coil are connected together with copper clips. On the outer side these clips are extended downward from the connections to the commutator, and into slots in the commutator segment. The collector rings are connected to the winding by solid bars securely fastened. The field winding is arranged for even compounding to give constant voltage at the terminals. The weight of the armature is about 4,400 lbs., and of the complete machine 17,500 lbs.

This three-phase system of distribution is specially designed to give the maximum of power at any point of the system on the most economical basis. A 500-volt continuous current direct from the rotary converters in the main station feeds the trolley lines for two miles on either side of the station, while the Middlesbrough and Linthorpe sections

of the lines are fed by a current transmitted at 2,500 volts from the main station to the sub-station at Newport, and there transformed down so that power is delivered from this sub-centre direct into the line at 500 volts.

The considerations leading to the adoption of this method of distribution have reference not only to the position of the main generating station and the properties otherwise available as car sheds, machine shops, &c., but to the length of the line, and the regulations of the Board of Trade as to the earth return. For reasons readily understood, the company was impressed with the importance of river frontage, and as this adjoined the property already acquired from the old company, the site secured was rendered suitable in every way for the main electric power station, while the Newport property was found to be situated most favourably for the purposes of a sub-station.

The generating station switchboard consists of 14 polished marble panels having a total overall length of 29 feet 4 inches, and a height of 10 feet 3 inches. The various panels are :—One boosting rotary converter panel, one battery panel, three transformer panels, three generator panels, two high tension feeder panels, two rotary converter panels, one line feeder panel, one Board of Trade panel.

A special feature of the switchboard are the high tension switches. These switches are double break ; all contacts are mounted on ebonite pillars and placed on opposite sides of an insulating plate, so that no arcing can take place between the positive and negative terminals. The switches are placed high up out of reach, above the top of the panels, and are operated by the handles shown in the illustration.

The sub-station switchboard consists of 13 polished marble panels, having an overall length of 23 feet 4 inches, and a height of 10 feet 3 inches. The various panels are as follows :—Six transformer panels, two high tension feeder panels, three rotary converter panels, one line feeder panel, one Board of Trade panel. In general arrangement and construction this switchboard is similar to that in the main generating station.

The transformers are of the air blast type, a blower forcing a current of air through the core and winding for the purpose of carrying off the heat. Frequent open spaces in the iron lamination of the core and between the coils of the winding form ducts, through which a constant supply of air is forced, so as to thoroughly cool all parts of the apparatus. The air blast is obtained from a blower, operated by a direct current motor of $1\frac{3}{4}$ H.P., taking current from the 500-volt bus bars.

The feeder cable which transmits the three-phase current at 2,500 volts from the central power house to the sub-station consists of two centre core cables, in each of which are three conductors of copper suitably insulated, each conductor having an area of 50 square millimetres or ·0775 square inches. With this small section it is possible to transmit 300 kw., with a loss of less than 5 per cent. At the sub-station this current is reduced by "step-down" transformers of 80 kw. capacity to 320 volts ; and this current is then passed into the alternating current side of a rotary converter, from which a direct current of 500 volts is drawn to feed the portion of line supplied from the sub-station.

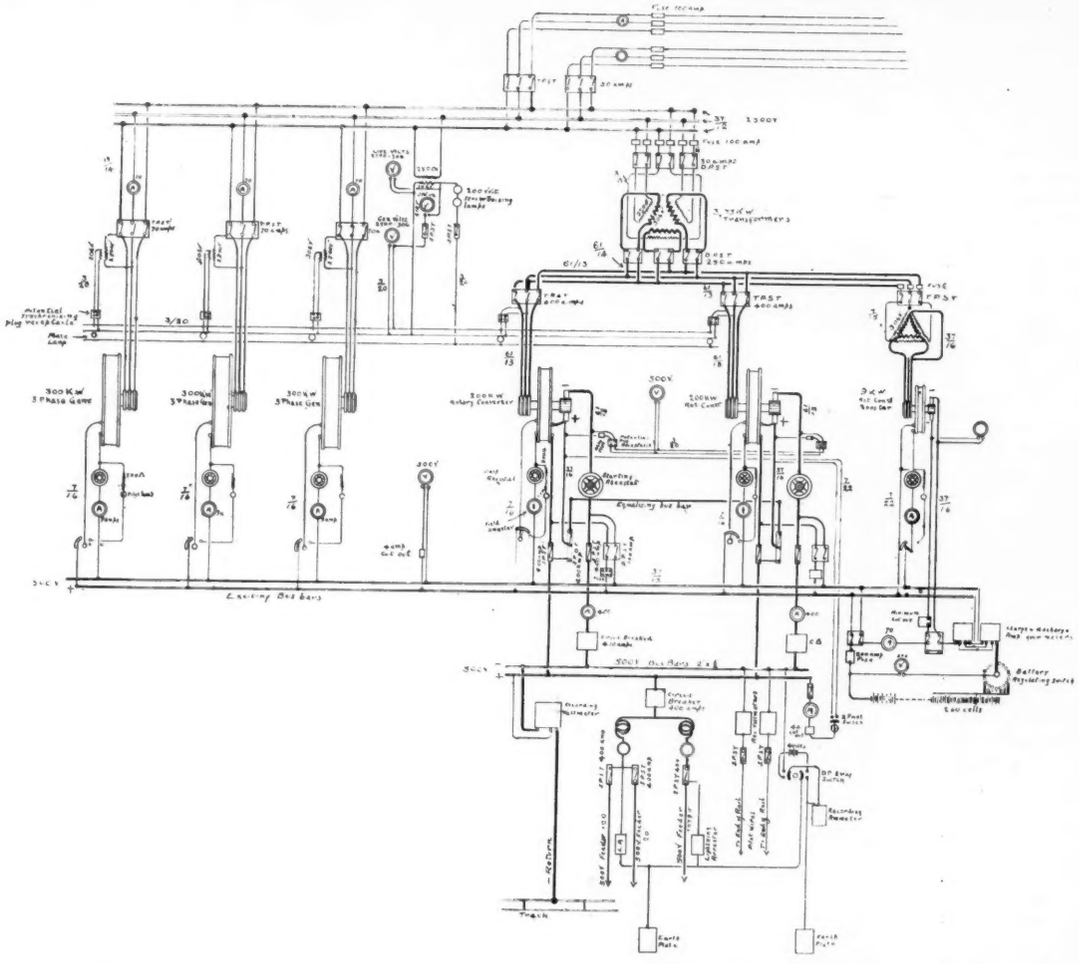
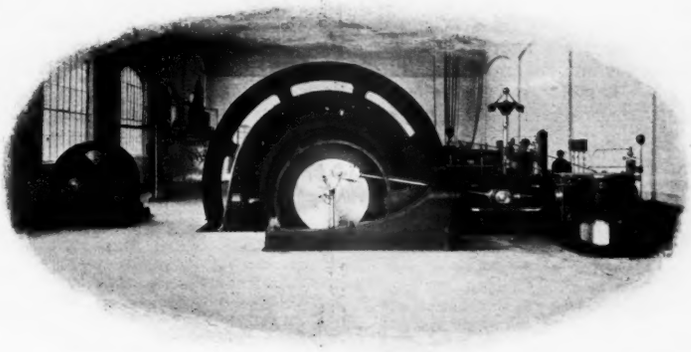


Diagram of Generating Station Switchboard.

A novel feature of the main station equipment is a combination of static and rotary transformers for charging the batteries.

The charging current is passed through the rotary, and the volts raised from the line voltage (500 volts) to a maximum of 650 volts for charging. There being no direct current primary generators in the station, it became a problem how to charge the batteries for supplying the excitation to the H.T. three-phase generators.

This was solved in the following manner:—A rotary converter was designed to supply the difference between the line voltage and the variable voltage required for charging; combined with this was a static transformer, having a ratio of transformation of 330 to 80 volts on a non-conductive load; the transformer was designed with a large amount of leakage between the primary and secondary, the leakage being adjusted so that by changing the phase of the armature current by variation of the field current of the booster, the transformer ratio is varied, and consequently the voltage on the collector rings. In this way it is possible to vary the voltage on the continuous side of the rotary from 40 volts to 150 volts. The charging current is 60 amperes. The armature of the rotary is designed to carry 60 amperes continuously.



View of Rotary Converter, Engine and Three-Phase Generator.

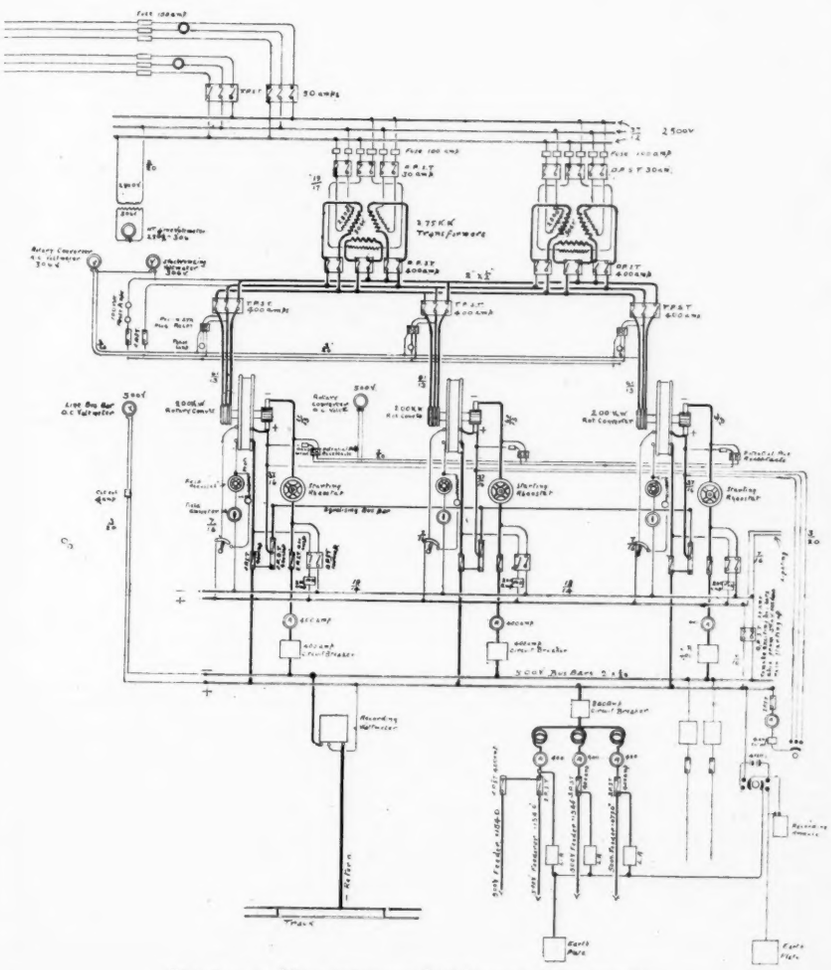


Diagram of Middlesbrough Sub-Station Switchboard.

The Outside Work.

In Corporation Road, Newport Road, and Albert Road, in Middlesbrough, and Bridge Road and High Street, Stockton, centre poles are used, all the remainder of the route being fitted on the side pole and bracket system. The poles are of ornamental design, 20 feet in height above the tracks, and are made of steel tubes in three lengths, which overlap, and are jointed and secured together by a special process while hot. The pole is sunk 6 feet in the ground, being embedded in Portland cement concrete, and an ornamental cast-iron base is provided, which rests on the kerb on the side walk. The poles are placed at an average distance of 120 feet apart.

The bracket arms which support the trolley wires are composed of steel tubes, supported at the inner end by an ornamental scroll in wrought-iron, giving to the pole a most artistic finish. Two wires running from end to end of the lines convey current to the car motors by means of trolley poles fitted upon each car. These wires are 000 of hard drawn copper, ·364 inch in diameter, and are divided by sectional insulation. There are overhead points and crossings at the ends of the lines and at the branches leading into the main and sub-stations, and on the lines as well as in the sub-stations the cars are moved and handled entirely by the trolley.

The section pillars are of cast-iron, and are placed at each half mile section on the road. They are about 4 feet in height, and are placed on the kerb lines, so that they are accessible from either side. They contain switches for connecting up or disjointing the sections of trolley wire, so that by their aid it is possible to cut out a section of trolley line or feeder as may be desired, without interfering with other parts of the line.

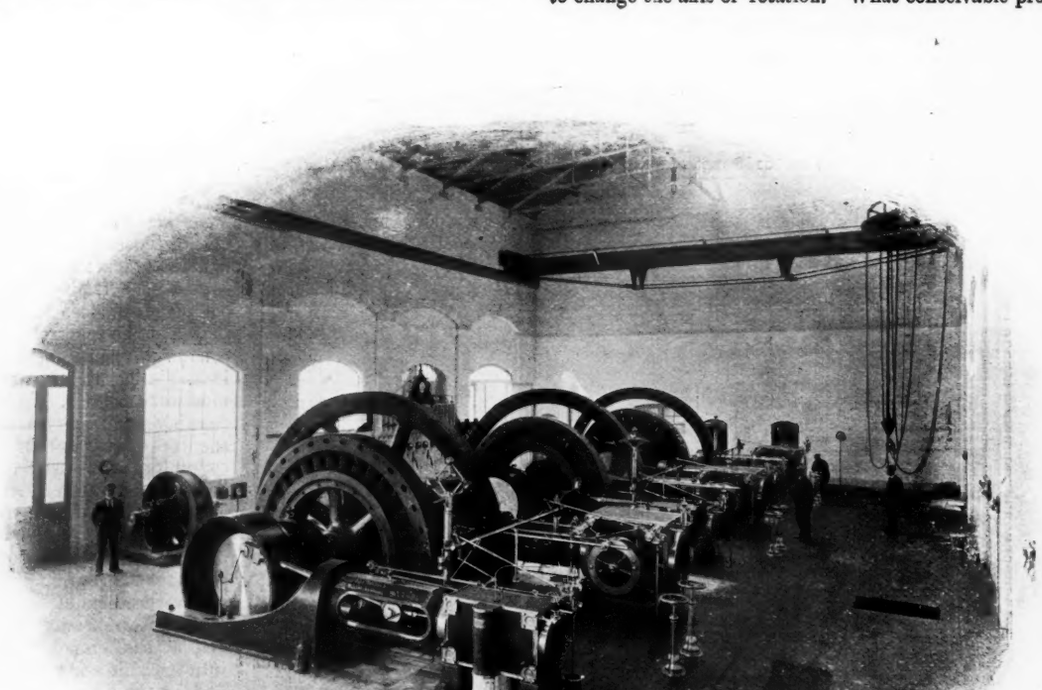
The bond adopted is that known as the "Columbia 0000 rail bond," which presents itself as the most efficient in respect to contact and solidity when fixed. This bond is of solid copper with bent terminals. The terminal is inserted in a hole clean drilled on the inside of rail, and a copper thimble is put in from the outside, the two are then steadily expanded with a screw cramp by hydraulic pressure, thus obviating the see-saw motion in the fixing of other

patterns of bonds which so often results in a bad or insufficient contact.

The whole of the electrical plant and equipment here described has been supplied under contract by the British Thomson-Houston Company, Limited, and the installation has been specially supervised by their consulting engineer, Mr. Horace F. Parshall, M.Inst.C.E.

New cars have been specially designed for this service and are each capable of seating 60 passengers. They are mounted on four-wheeled bogie trucks of the Maximum traction type, and each truck carries one G.E. 800 motor, the motors being connected up to series parallel controllers, type K-2, one on each end of the car.

The signal lamps, head lamps, and saloon lights are electric, 10 lamps being employed on each car; the internal lighting thus forms a great contrast to that of the old horse or steam cars.



General View of Three-Phase Generators.

It is only right that we should extend our congratulations to the Imperial Tramways Company, and to Mr. Clifton Robinson in particular, on the splendid system which they have completed. We made a close inspection of the whole of the plant, both inside and outside, and we were struck with the completeness of detail that characterised the whole of the work. No inspection has given us greater pleasure than that of the Middlesbrough and Stockton Tramways; it can fairly claim to be the model tramway of the country, and it should have great influence in determining the method of electric traction in other towns.

Miraculous Electricity.—It has been commonly reported that Edison had a plan for destroying his country's enemies by electricity by merely pressing a button, but we have never seen any description of his plan. A fellow countryman of Edison, however, has elaborated a plan which will do all that Edison professed to do, and a great deal more, and he has condescended to give details of his scheme and even estimates of its cost. In the *World*, N.Y, of July 10th, this scheme is described with a flaring illustration of the globe wound with a dozen turns of a cable, through which a current is being sent by a dynamo bigger than the great pyramid. The scheme of this "celebrated electrical engineer" is to turn the magnetic axis of the earth by means of these ampere-turns into the plane of the equator. This he might possibly effect, but owing to some curious twist in his mental constitution he imagines that the axis of rotation would follow the magnetic axis. Spain is thus conveniently transferred to the arctic regions, and the obstinate resistance of the Spaniard overcome in "the twinkling of an eye" by freezing him out. The only reason given for expecting this extraordinary result is that the iron in the sun would by its magnetism so act on the new magnetic poles of the earth as to change the axis of rotation. What conceivable process of reasoning would lead to this conclusion we cannot imagine. The "celebrated electrical engineer" appears to have put the cart before the horse. Change the axis of rotation and very probably the magnetic axis will follow it; for in the opinions of leading scientists the magnetism of the earth is caused by its rotation. The true theory of the origin of the earth's magnetism cannot be said to be established, but we have no hesitation in saying that the theory of the sensational writer in the *World* is the least likely of any we have heard. Scientific romances should have enough verisimilitude to save them from being ridiculous. Jules Verne's success was in great part due to the fact that he kept this maxim in view, the "celebrated electrical engineer" of the *World* has failed, even as a romancer, by neglecting it. But no doubt many of the readers of the *World* will look upon the article as a serious scientific prediction, and our contemporary becomes responsible for disseminating falsely so-called science. The result that would follow the realisation of this immensely costly and impracticable scheme would more probably be an epidemic of bad language among mariners than the freezing out of Spain.

ELECTRIC TRACTION AND MOTIVE POWER NOTES.

(*Continued from page* 234.)

Belfast.—The Belfast Tramways Company and the Corporation have been trying to come to terms over the question of electric traction. All agree that there are advantages to be reaped by the use of electricity, but it will be understood that the company cannot convert their system unless they get a reasonable extension of the lease to make it worth their while. Fourteen years was suggested but the Corporation made a dead stand against it and the matter dropped for a considerable time. Last week the Sub-Electric and Law Committee submitted a report to the Corporation on the subject, and there was a lengthy discussion. The introduction of electric traction, including some proposed extensions, is estimated at £525,000. The committee submitted the following heads of a proposed arrangement to a deputation from the company for consideration by the Board:—"1. The valuation of the company's lines, &c., as for 1907, to be now ascertained, so that the amount to be then paid by the Corporation therefor shall be fixed. 2. The lines, &c., to be kept in the like good repair by the company in the meantime as they are at present. 3. The company to assign to the Council their right of purchase of the subsidiary lines. 4. The company to work the lines electrically until the termination of the present term. 5. The Council to provide funds to make such extension as may be mutually agreed on, and to electrically equip the lines. 6. The company to pay — per cent. per annum on the funds expended by the Council, and — per cent. for depreciation. 7. The company to take electrical power from the Council at a price to be fixed yearly by an electrical engineer to be agreed on. 8. The company to be indemnified against loss from failure of the Corporation to supply power. 9. The company to assist the Corporation in procuring an Act of Parliament to carry out the arrangement. 10. The fares to be arranged either on the basis of ½d. for approximately one mile stages, or 1d. all the way in one car. If such a basis meet the approval of the Council and the company, the details to be arranged subsequently."

Cheltenham.—At last week's Council meeting Alderman Norman, in introducing the minutes of the Electric Tramways Committee said it was most important that the two railway stations should be connected by the proposed electric tramways. The only possible mode of getting to the top of Cleeve Hill was by the overhead wire system, no other system could be practically adopted. There were four applications from persons or companies willing to undertake the tramway line, the Committee had decided to prefer the application of Mr. Nevins, and they had done so because Mr. Nevins had acted very honourably towards the Council on the previous occasion when the subject was considered. Mr. Nevins was acquainted with the requirements of the town, and he knew the route, which other applicants did not know so well, and they had already, on a previous occasion, arrived at an understanding with him as to certain details in connection with the laying down of the line. The committee consider that the pitching or paving along the route should be either of Australian or other hard wood blocks or of the MacDougall bricks. Although the initial cost of wood blocks was greater than macadam, the expense of subsequent maintenance was very much less, but the matter of paving would be left for the Council to determine. The committee thought that owing to the amount of traffic between the Midland and Great Western stations it was sufficient to justify two lines, and he (the speaker) hoped that the Council would pass both routes. There was every reason to believe that property along the routes would greatly increase in value when the line commenced.—Councillor Mills seconded the adoption of the minutes.—Councillor Major-General Macdonald moved the following amendment: "That the Queen's Road and Lansdown Road route be dropped."—Alderman Drew seconded the amendment. After discussion Councillor-General Macdonald's amendment was carried and the minutes confirmed.

In a letter to the Town Clerk Mr. Nevins stated that, if possible, he would undertake the construction of the tramways in the winter, so as to have them ready for running by next summer.

Colombo.—The electric tramways are progressing. The *Ceylon Observer* says that there is not much more to be done to complete the permanent way, and the central power station is now constructing at the Pettah, the men being at work day and night. The machinery and apparatus were in Ceylon last month awaiting erection. The cars may start running before the end of the year.

Dublin.—In an article on the progress which is being made with the construction of electric tramway extensions in Dublin, the *Daily Nation* says that:—"The work in connection with the equipment of the city with a full and complete electric tram system, is advancing every day. The Haddington road extension to Nelson's Pillar is completed. It will be some time, however, before the cars will be able to perform the entire journey to the Pillar, as owing to the fact that the Drainage Works are in progress on the O'Connell Bridge, the trams from Haddington Road cannot cross at this point. The North Quay line is practically completed, and will, in due course have its electric system service running, with the highly satisfactory result that a continuous connection between Parkgate Street and the Pillar will be established. The line connecting Rathmines and Ballsbridge, constructed for the purpose of bringing the inhabitants of the former township within easy reach of the sea, has been completed, and it is expected that within the next few days horse cars will be running over this section. On the North Circular Road the work of converting the line into an electrically equipped connection between the Phœnix Park and the Pillar is progressing rapidly, while on the Harold's Cross and Palmerston Park lines a similar work has been taken in hand, and the necessary operations are already being pushed forward energetically in George's and Aungier Streets. Taking it all round, the work is in a very advanced state. Of course, a great deal still remains to be done before every line which has been undertaken will have its tram service complete and in full working order, a very great deal depending in this regard upon the erection of the Ringsend Power Station, which has yet to be constructed. The promoters, however, are not without hope that the commencement of the next year will see Dublin in possession of a tram service far superior to that of any city in the United Kingdom, and quite as effective as any similar service of which any city in America can boast."

Farnborough.—Messrs. Wm. Webb & Co. have intimated to the Lambeth Vestry that the application to the Light Railway Commissioners for an order to authorise a light electric railway from Herne Hill to Farnborough will not be proceeded with.

Glasgow.—Last week the Corporation approved of the proposals of the Tramways Sub-committee for the constructing of various sections of new tramways making altogether 11·13 miles of extensions. The recommendation was made "in anticipation of horse traction being superseded." A Bill for the new lines will be promoted in the next Parliamentary session, and as in the meantime the Springburn trolley line will be opened, we may, we suppose, take it for granted that the above new lines will be equipped on the same method.

Greenock.—The Electricity Committee has decided to approach the Greenock and Port Glasgow Tramways Company with the view of ascertaining whether, in the event of municipal electrical works being put down, they would employ electricity for the working of their tramways.

Huddersfield.—The members of the Huddersfield Corporation have been provided with a report relative to the application of electric traction on the Lindley and Outlane sections, and Mr. J. Pogson, the tramways manager, deals exhaustively with the question and gives many facts and figures. The approximate cost of equipping the section for electric traction is as follows:—"Equipment of line, including overhead construction poles, bonding, and feeder pillars, £10,750; engines and dynamos, £4,300; eight motor cars, £5,200; battery, £750; feeders, £5,000; engine foundations, battery house, car house, spare parts, and sundries, say, £2,000; total, £28,000; say, £4,200 per mile The financial and other charges for the items, viz., £4,300 for engines and dynamos, and £5,000 for feeders, should be included in the charge of 1½d. per unit for the current." The total income required to balance estimated expenditure is £9,902, and the actual income for last year for the present system and mileage was £8,236. These amounts leave £1,666 to be earned by the extension of the tramways to Outlane, and the increase of 12 per cent. on the mileage on the existing system.

Hull.—The laying of the electric tram lines is in full swing.

Johannesburg.—A movement is again on foot to get a concession from Government to inaugurate a system of electric trams for Johannesburg. The *Standard and Diggers News* says that endeavours are being made to enlist the sympathy of the Raad members.

Johnstone.—At Johnstone Town Council on Monday Provost Thomson and all the members expressed their complete satisfaction with the working of the electric tramways in Rouen and Havre, where they had been on a visit of inspection. It was unanimously agreed to invite the British Electric Traction Company to take steps to have the system extended to Johnstone. Mr. Wm. Reid said the matter would come before the Board of Trade next month for their consideration and approval. A resolution was adopted thanking the Electric Traction Company for their generosity and courtesy in sending a deputation to the Continent to judge on the important question of electric tramways.

Leeds.—At a recent City Council meeting it was stated with regard to the tramways that the gross receipts for June were £4,273 in excess of the receipts for the corresponding month of the previous year, an increase equal to 72 per cent., but that the profits for the past financial year only amounted to £343.

Limerick.—Mr. Warden-Stevens appeared before the Corporation the other day to ask for the position of consulting engineer in connection with the electric tramway which has been suggested for the city. At present he is engaged in the electric lighting of Fermoy, and he would proceed from that place to Queenstown for a similar purpose. He pointed out the necessity for having expert advice before any system of electric tramways was decided upon, as one system of electric tramways was not suitable to every place, the local conditions and circumstances being absolutely essential points for consideration. The plans of the different companies would have to be examined carefully, and a report prepared by an expert should go before the Corporation. Mr. Warden-Stevens was to appear before the Council yesterday.

Liverpool.—It appears that Sir Arthur Forwood has rejoined the Tramways Committee as deputy-chairman. The policy of the Committee was assailed by several members of the City Council last week, and in the course of a reply the chairman (Mr. Oulton) said that: "He accepted the chairmanship of the committee having a definite line of policy, and the city might reasonably look forward to the completion of the experimental route to the Dingle by September, and the establishment of mechanical traction all over the city within a space of two or three years."

Metropolitan District and Electric Traction.—Mr. J. S. Forbes, chairman of the Metropolitan District Railway, made the following statement to the shareholders on Friday last, *re* electric traction: "You know we have also received sanction in a Bill to supply electricity to our railway, and we are now in accord with the Metropolitan on that subject. We have authorised two perfectly competent people, Sir J. Wolfe-Barry, and Mr. W. H. Preece, the electrician of the Post Office, and at present president of the Society of Engineers, to study this matter specifically and experimentally. Of course, one knows something about the ordinary electrical railway made with express reference to electrical traction—tunnels of a moderate breadth and height, &c., such as those that are being constructed under Oxford Street. Our railway is a totally different problem. There we have our way made part in tunnel, part in the open, part on girders, part on arches, &c., involving very difficult questions of structure, and with a certainty, that, for a time at least, we shall be under the obligation to admit on our railway under running powers enjoyed by the companies, the trains of some others which will probably be propelled by locomotives. Therefore, the problem is not so easily settled as is that of the question of the underground railway in the centre of London, or in the south of London. The Italians say that men who go slowly, go surely. We cannot afford to be in a hurry over a matter of this sort. Then there is another scheme—a very ambitious one—and that is the duplicate railway under the District between Earl's Court and the Mansion House. Well, that is a very big job. I think I told you at one of these discussions we have had upon these points for the last two or three years that that involves very serious financial liabilities, and liabilities of a character which it may possibly be wise to meet a little later on. We have got a term of years to think it over, and when we have felt our way a good deal more than at present on the question of electricity as applied to an existing railway, we can turn our minds to the bigger question, when, probably, it may be more easy to raise £1,500,000 or £1,600,000 for such an object, than it is at present."

Middlesbrough.—Messrs. George and Samuel White acted as hosts to a large party of members of the Bristol Stock Exchange, who paid a visit last Friday to the Middlesbrough, Stockton, and Thornaby electric tramway system which has just been opened. Mr. Clifton Robinson met the party at Saltburn, where lunch was served at the Zetland Hotel. On Saturday the party went over to Middlesbrough, and a special car covered with floral decorations conveyed them over the system. Luncheon was served at the power station, and there was much happy speech-making.

Oldham.—The Surveyor's Committee recently resolved:—"That the Council be recommended to authorise and direct this committee to take all the necessary proceedings to promote in the next session of Parliament a Bill for the purpose of authorising and enabling the Corporation, subject to existing leases, to work any tramways for the time being belonging to them either by electric, animal, or other power, and to place and run carriages thereon, and to take tolls, rates, and charges in respect of the use of such carriages, or to lease the said tramways if the Council should determine to do so; to construct and lay down additional tramways within the municipal borough, and in case any of the townships within the Parliamentary borough should desire the Council so to do to enable the Corporation to enter into agreements with the authorities thereof to lease, work, and use any tramways for the time being situate or to be constructed in all or any of the townships, or to supply electric or other power to enable such authorities to work and use their respective tramways." The Town Clerk was instructed to write the authorities within the Parliamentary borough to obtain their views on the matters mentioned in the resolution referring to their respective districts.

At a meeting of the committee on Wednesday, last week, Alderman Eckersley, chairman, said he hoped the members would look carefully into the matter before the next meeting. A number of the members asked that they may be supplied with a copy of Prof. Kennedy's report on the subject, and the borough surveyor promised that such should be done.

When the matter came before the Council last week, Alderman Eckersley, referring to the minutes of the Surveyor's Committee, said that: "They proposed various extensions in connection with the scheme, which they intended to carry out with the consent of the Council. They should begin with 350 yards of tramway in Middleton Road from the borough boundary to Featherstall Road, and then go forward up Middleton Road to St. Domingo Street; and then they proposed to put down rails the full length of Hollins Road, Park Road, and King Street, to Glodwick, and along Glodwick Road to Cross Street. It had also been mentioned to put in lines the whole length of Lees Road, Shaw Road, and Ripponden Road to a certain point. It had also been incidentally mentioned that it would be an advantage to make the route up Henshaw Street, Market Street, and Chadderton Road to the borough boundary. The committee had received communications from the out-districts—Royton, Crompton, and Lees—and they seemed to be in favour of joining with Oldham in the proposed scheme. The committee were unanimous in the view they put forward as to promoting a Bill in the next session of Parliament. The Committee will make the requisite inquiries as to cost, and will report.

Redcar.—At a recent Council meeting a letter was read from the manager of the Middlesbrough Electric Tramway Company relating to the application of the Council to run to Redcar, saying that the matter would be submitted to the directors for their consideration.

South Staffordshire.—On Monday, at a meeting of the Wednesbury Town Council, the Mayor (Alderman Oldbury), proposed a resolution to the effect that it is desirable that all the local authorities within the district of the South Staffordshire Tramway Company should take steps with a view to purchasing the tramway lines within their respective districts, and also to oppose the proposed application to Parliament of the British Electric Traction Company, Limited, for a Bill to confirm a lease of the tramways to that company. The Mayor also stated that he was in favour of overhead electric traction, which he considered far superior to steam.—The motion was seconded by Councillor Lawrence.—Alderman Williams opposed the resolution, declaring that it seemed to be nothing less than a craze. One followed another, he said, like a flock of sheep, without consideration of the question. They could do nothing for four years, and how were they to bind their successors to a policy on paper that day? The only object that he could see was that they would obtain absolute control over the roads; but the roads through which the tramway passed were the best in the borough, and there was a saving of £200 or £300 owing to the repairs done by the company.—Councillor Lawrence said that the remarks of Alderman Williams were insulting to the representatives of Wednesbury, Walsall, and the other local authorities which had met and discussed the question.—The motion was subsequently supported by Alderman Wilson Lloyd, Councillor J. Griffiths, and by the Mayor. It was agreed to by a large majority, only Alderman Williams, in fact, opposing.—A similar resolution to the above was passed at a meeting of the Walsall Town Council on Monday without opposition.

Southampton.—The umpire in the Southampton Tramways Arbitration, appointed to determine the sum to be paid by the Corporation for the acquisition of the undertaking, has reported as follows:—"I award and determine that in case the Court shall be of opinion that the arbitrators and umpire appointed as aforesaid should treat the undertaking of the company as defined by the Act of 1897 as an undertaking which the Tramways Company only enjoyed subject to the contingency of being compelled to part therewith under the terms of Section 43 of the Tramways Act, 1870, the price to be paid under the Act of 1897 as aforesaid, is the sum of fifty-one thousand five hundred and five pounds (£51,505). I award and determine that if the Court shall be of opinion that the said arbitrators and umpire should treat the undertaking of the company as defined as aforesaid as an undertaking which the Tramways Company enjoyed free from all obligation to part therewith other than the obligation created by the Act of 1897 itself, the price to be paid under the Act of 1897, as aforesaid, is the sum of one hundred and nine thousand nine hundred and sixty-three pounds (£109,963)." When the case was before the umpire and arbitrators the company's claim, as stated by Mr. Glenn, the secretary, upon the basis of profits at 22½ year's purchase, was £120,532, and the valuation made by the Corporation upon the basis of structural value was £37,963. Taking the latter valuation the umpire's figures exceed those of the Corporation by, in round figures, £11,500, whilst on the alternative basis he decides that the company asked £10,500 too much. Unless the parties can come to terms the opinion of a Court of Law will have to be taken as to which of the valuations is legally correct.

St. Helens.—The Electric Lighting and Traction Committee have adopted a new time table for the tramways on the inauguration of electrical traction, which is now being introduced. The Prescot section will consist practically of a half-hourly service throughout the day with a 15 minutes' service to St. Ann's. There will be a 15 minutes' service on the Denton's Green and Peasley Cross sections, and a 20 minutes' service to and from Haydock.

Walton-on-the-Naze.—The pier electric tramway has been constructed and opened. Messrs. Lowdon Bros., of Dundee, carried out the work, under the supervision of Mr. Geo. Balfour, A.I.E.E. The plant comprises a locomotive type boiler, a 50-H.P. compound vertical engine directly coupled to a dynamo for supplying current for three cars. The third rail system is employed, and Peckham trucks are used. The pier is lighted by means of 100 C.P. lamps. The length of the railway is just under half a mile. The contractors handed over the undertaking to the Pier Company last week.

The Waterloo and City Railway.—This new electric underground was opened for public traffic on Monday last and seems to have been well patronised. Each train with its four coaches will accommodate 240 passengers. The journey occupies about five minutes, and the trains run at short intervals throughout the day. There is only one class. The fares and season ticket rates have been fixed as follows:—Fares (to be paid at the turnstiles), single, 2d.; return, 3d. Season tickets.—Twelve months, £3 10s.; six months, £1 16s.; three months, 19s. London and South Western season tickets can be made available on the Waterloo and City Railway by the payment of the additional charges mentioned. In the first instance, at least, there is not to be any Sunday service.

Wigan.—The Royal assent has just been given to the Wigan Corporation Act, 1898, by which power is obtained to work the tramways in the district by mechanical power. The Wigan tramways were first worked by horses, but now the cars are drawn by steam engines. Should a change to electric traction be desired, the Corporation have power to construct and maintain a station for generating electric energy on a portion of their gas estate. In the event of any of the tramways being worked by electricity, there are protective provisions in favour of the District Councils of Ince, Pemberton, and Hindley, through whose areas the present lines run. At last week's meeting of the Wigan County Borough Council, the hope was expressed that the Wigan and District Tramways Company would ask the Corporation to put down electrical traction to substitute the present steam power.

TELEGRAPH AND TELEPHONE NOTES.

Building a Pacific Cable.—The New York *Electrical Engineer* discusses the desirability of having an American Pacific cable, editorially, in the following terms:—"This country can never be a European power, but it is rapidly becoming a great Oriental power, and it is high time we built the Pacific cable about which there has been so much talk. Even if Spain should not wholly surrender her Pacific colonies now in making peace, she will have to let go sooner or later, and then we shall have to step in once again. The Sandwich Islands are ours by sheer weight and drift of events, and it is imperative for our future trade to keep "open doors" in the Far East, wherever possible, so that the hand of fate compels us also to insist on a prominent place in that part of the world, as owners if need be, but as rightfully there anyhow. We will go there peacefully if we can; but if we cannot we will smash anything or anybody that gets in our way. [Go it, brother Jonathan! You've done your duty by Cuba, the next thing to fight for must be this "open door." We are with you heart and hand.—Eds. Elec. Rev.] Such being the case, it is foolish any longer to be in touch with our dependencies and markets by the roundabout way of Europe; and this Pacific cable landing on our Californian shore and running thence to Hawaii, Japan, the Philippines, China and Australia must be built forthwith. That is a large contract, but that country is equal to the outlay, and as we have not yet got the construction and laying plant, our English friends will gladly welcome the opportunity to do the job for us, [Certainly we will: what say you, Messrs. I. R. G. P., T. C. and M., Henley's, &c.?—Eds. Elec. Rev.] while their Government will lend all the aid it can, if only for selfish motives, and the more readily because our coming promises the success of that larger generous plan of commercial intercourse under which there is no discrimination. We are glad to note, therefore, that the Executive Council of the Hawaiian Government has granted to the Pacific Cable Company the right to land a cable there which will connect with the U.S.A., China, and Japan. All told, the company proposes to lay 12,345 miles of cable, and the Honolulu section is to be laid within a year from the time that Congress grants the proper authority, which, we imagine, will now be easily obtained, with the addition of a reasonable subsidy to be offset by the free transmission of governmental messages. The Pacific Cable Company, with a capital of $10,000,000, and with such men as J. P. Morgan, J. K. Tod, J. A. Scrymser (of the Central and South American cables), Admiral Erwin, and E. L. Baylis, ought to be quite competent to carry out its plans and purposes in good style, and should find an excellent return for its investment."

It is stated in an American newspaper that "on July 20th the Executive Council of the Hawaiian Government signed a contract with the Pacific Cable Company to lay a cable between the United States, Hawaii and Japan, China and the Philippines, the contract being for a period of 20 years. The Pacific Cable Company is capitalised for $100,000,000 (*sic*). James A. Scrymser is president and Edmund L. Baylis is vice-president. The other directors are Admiral John R. Irwin, J. Pierpont Morgan, and J. Kennedy Tod. The company has been operating quietly, with the co-operation of this Government and Hawaii, pending the annexation proceedings." It is added that the work of laying the cable is to be completed within six months, and that most of the surveys have already been taken. The price to be paid is said to be $10,000,000.

New French Cable in the Soudan.—The *Pall Mall Gazette* Paris correspondent says that information was received on Monday at the Ministry of Colonies to the effect that the new telegraphic line destined to connect the Soudan and Senegal with the French colony of Dahomey will shortly reach Fada N'Gourma on the Soudanese side, and go beyond Djiougou to the north of Carnotville on the Dahomey side. The junction of these two lines will be accomplished by the end of the year, and after next year regular communications will be established between Senegal, the Soudan, and Dahomey, thus freeing French West Africa from the necessity of utilising the English submarine cables on the African West Coast.

The Pacific Cable.—In the House of Commons last week, Mr. Lowles asked the Secretary for the Colonies whether, seeing that the Government of the Dominion of Canada had expressed its willingness to contribute or guarantee one-third of the cost of an all-British cable *viâ* the Pacific to the Australasian colonies, and that the Governments of the latter had also publicly notified their readiness to contribute or guarantee a similar proportion, Her Majesty's Government would agree to contribute or guarantee the remaining third. Mr. Chamberlain said, in answer to the first question of the hon. member, that no official communication had been received from the Government of Canada or from the Governments of the Australasian Colonies of their willingness to contribute or guarantee two-thirds of the cost of an all-British Pacific cable. Should such communications be forwarded they would receive due consideration from Her Majesty's Government.

St. James Vestry, Westminster, and the Telephone Company.—A long discussion took place at the last meeting of the Vestry consequent upon the presentation of a report by the Works Committee on a letter received from the National Telephone Company. The company stated that serious inconvenience had been caused to a number of their subscribers through an interruption in the service owing to the fire which occurred in Heddon Street; that they were experiencing considerable difficulty in replacing the wires overhead; and submitted a scheme for placing the wires underground, by which it is proposed to lay mains and run wires to distributing stations in a number of streets in accordance with a plan submitted. In this connection the Works Committee mentioned that they had ascertained that the company were prepared to enter into an agreement to pay 5s. per annum for every separate exchange subscriber's line whose premises are situated within the parish, and that they had been informed by the metropolitan superintendent and district manager, who attended the committee, that there are about 360 subscribers in the parish. The committee recommend that subject to the company submitting an amended plan and application, omitting the condition relating to further extensions, and agreeing to pay the sum of 7s. 6d. in lieu of 5s. for each separate exchange subscriber's line, the application should be granted. The Vestry Clerk stated during the discussion that the company had written stating their inability to pay 7s. 6d. for each line. Eventually, on the motion of Mr. Cheney, an amendment was adopted by 13 to 7 votes deciding to invite the local authorities adjoining the parish to a conference to discuss the question from all points of view.

The Telegraph Wire Export Trade.—The fluctuating character of the export trade of this country in telegraph wire and apparatus connected therewith is well illustrated by the returns which have just been issued relating to the shipments during July. From £14,528 in June, they declined to only £45,600 last month, which compares with £136,547 in the corresponding month of last year, and £53,139 in July, 1896. The figures for the seven months ending with July show a total value of £546,496, as against £607,273 in the same period of last year, and only £396,402 during the first seven months of 1896.

Telegraphic Interruptions and Repairs:—

Cables.	Down.	Repaired.
Brest-St. Pierre (Anglo, 1869)	April 6th, 1898 ...	...
West Indies—		
St. Croix-Trinidad ...	Nov. 30th, 1896 ...	...
Caimanera-Santiago de Cuba	June 10th, 1898 ...	...
Amazon Company's cable—		
Cable beyond Gurupa ...	June 8th, 1898 ...	...
Accra-Kotonou	Aug. 8th, 1898 ...	...
Hong Kong-Manila	May 3rd, 1898 ...	...
Cyprus-Latakia	Feb. 10th, 1898 ...	...
Bolamo-Bissao	July 21st, 1898 ...	...
Cape Town-Mossamedes ...	Aug. 2nd, 1898 ...	...
Olehleh-Medan	Aug. 9th, 1898 ...	...
Landlines.		
Trans-Continental line beyond Mazol	March 12th, 1896 ...	...
Cartagena-Barranquilla ...	July 4th, 1898 ...	...
Saigon-Bangkok	August 1st, 1898 ...	August 7th, 1898.
Siberian lines, Ischita-Stretenskaia	August 8th, 1898 ...	...

Telephone Communication between Paris and Berlin.—The Belgian Government is reported to have proposed to the German Government the establishment of telephonic communication between Paris and Berlin *viâ* Brussels. The French Government, it is said, has already approved of the scheme.

CONTRACTS OPEN AND CLOSED.

OPEN.

Ashton-under-Lyne.—August 29th. The Electricity Committee want offers from persons desirous of entering into arrangements for the wiring of premises within the borough on any system of deferred payment. Particulars from Messrs. Lacey, Clirehugh and Sillar. See our "Official Notices" August 5th for particulars.

Bangor.—September 10th. The Corporation is inviting tenders for the supply and erection of two water-tube boilers, economisers, steam and other pipes, pumps, &c., two 60-kw. dynamos, balancer, boosters, 5-ton travelling crane, switchboard, accumulators, mains, &c. Consulting engineer, Mr. F. H. Medhurst. See our "Official Notices" for particulars.

Buxton.—September 5th. The District Council wants tenders for the supply of water-tube boilers, mechanical stokers, engines, dynamos, pumps, &c., battery, switchboard, exhaust, feed, and other pipes for the establishment of electricity works. Consulting engineer, Prof. A. B. W. Kennedy. See our "Official Notices" this week.

Halifax.—August 24th. The Corporation Tramway Committee is inviting tenders for excavating and forming about 5 miles of tramway track within the borough. Particulars on application to Mr. Edward R. S. Escott, C.E., borough engineer, Town Hall, Halifax.

Hull.—August 25th. The Electric Lighting Committee want tenders for the supply and erection of a 750-I.H.P. Willans or Belliss type engine, a 460-kw. high tension continuous current dynamo, and two 30-feet × 8 feet Lancashire boilers, for the electric light works. City electrical engineer, Mr. A. S. Barnard. See our "Official Notices" July 29th.

London.—August 15th. The managers of the Central London Sick Asylum District are inviting tenders for electric lighting plant for the new asylum, Hendon, Middlesex. Specifi-

cation, &c., from the architects, Messrs. Giles, Gough & Trollope, 38, Craven Street, Charing Cross, W.C. See our "Official Notices" July 22nd for particulars.

London.—August 17th. The East Indian Railway Company is inviting tenders for the supply and delivery of electric overhead travelling cranes and a steam electric power plant. Specifications to be seen at the offices, Nicholas Lane, London, E.C. Tenders are to be sent to Mr. A. P. Dunstan, secretary, marked "Tender for Travelling Cranes," or as the case may be, not later than 1 p.m. on 17th inst. The company reserves to itself the right to divide the order. A 21s. fee is charged for each specification.

North Staffordshire.—September 5th. The British Electric Traction Company is inviting tenders for the provision of materials and construction of the track and permanent way of about 13 miles of tramways (in sections) in the Potteries district of North Staffordshire, for the British Electric Traction Company, Limited. Particulars obtained on payment of a deposit of £3 3s. at the Company's Permanent-way Engineer's Office, Donington House, Norfolk Street, Strand, W.C.

Patras.—The following notice appears in the *Times*:—"On Sunday, the 16·28 August of this year, in the morning, from 9-11 o'clock, will be given out in submission, in the Town Hall of Patras, in presence of the Municipal Council, and in public session, the concession of the lighting of Patras and its suburbs. In case the lighting will be executed by gas, the period of the concession will be of 35 years, or in case the lighting will be executed by electric light or another light, the duration of the concession will be left to the discretion of the competitor, according to the conditions of our advice No. 2,222 of this year and according to the register of February 7th, 1898, modified by the above-mentioned advice No. 2,222. Offers are to be submitted under sealed cover. A copy of the above-named documents, in Greek or in French, will be delivered to every interested firm which will ask it from us or from the president of the municipality.

"Patras, July 12th, 1898.

"The Mayor of Patras,
"Thanos Canacaris."

Rochdale.—September 6th. The Corporation wants tenders for the supply of boilers, economisers, condensing plant, feed pumps, steam and exhaust piping, travelling crane, switchboard, accumulators, and cables for the electricity installation which is to be put down. Consulting engineers, Messrs. Lacey, Clirehugh and Sillar. See this week's "Official Notices" August 5th for particulars of the various sections.

Roumania.—September 22nd. Tenders are being invited until September 22nd by the municipal authorities of Braila, Roumania, for the concession for the electric lighting of the town. Particulars may be obtained from, and tenders are to be sent to, La Mairie de Braila, Roumania.

Shoreditch.—August 15th. The Vestry invites tenders for the erection of a new battery room, boiler house, and extension of offices at the Electricity Supply Station, Coronet Street, Shoreditch. Drawings, specifications, &c., at the offices of Messrs. Kincaid, Waller & Manville.

Spain.—Tenders are being invited until the 22nd inst. by the Spanish Post and Telegraph authorities in Madrid for the supply of 22,000 rolled zinc cylinders required in connection with the telegraph service. Particulars may be obtained from, and tenders to be sent to, La Direccion Général des Postes y Telegrafos, Madrid.

Wimbledon.—August 29th. The District Council invites tenders for the supply, delivery, and erection of pipe work. Mr. A. H. Preece, consulting engineer. See our "Official Notices" August 5th.

CLOSED.

Brighton.—Messrs. Callender's Cable Company have secured the contract for the supply to the Council's electricity works of cables (unarmoured and armoured lead-covered) for the year ending August 31st, 1899.

Fareham.—At the last meeting of the District Council it was resolved that the tender of Messrs. Davey Paxman, Colchester, for the supply of an engine and alternator at the electric light works, for the sum of £912 be accepted, on the understanding that the noise of the alternator should not be heard outside the generating station.

Italy.—Messrs. Felix Singer & Co., of Berlin, have secured a contract from the Società Romana degli Tramways-Omnibus of Rome, for 30 electric motor and tramcars on the Walker system.

South Shields.—An exchange says that the following tenders were sent in for laying 185 lineal yards double-line steel girder tramway, electrical bonding, and paving thereto, for the Corporation of South Shields:—

Laing, Wharton & Down, London	£2,377 5 0
Thornton & Co., South Shields	1,318 10 0
G. E. Simpson, Newcastle	1,001 6 3
A. Brunton & Son, Edinburgh (accepted)	660 0 0

NOTES.

The Falls of Foyers.—Were we to believe the exaggerations of enthusiasts we should view the Falls of Foyers as a beauty of the past. It is not surprising that certain statements should lead some writers in the press, as well as others who are anxious for the well being of the land, to ask the question, "Are the Falls of Foyers really gone?" Canons and other great guns have thought they were commissioned to rescue the Falls from threatened oblivion, or to prevent their total destruction by the manufacture of aluminium in the neighbourhood. One who claims to know the locality intimately says:—

The water has been entirely withdrawn from the Falls except when there is an exceptional flow, and arrangements are being made for the withdrawal of that also. A very foul smell issues from the factory and is perceptible a considerable distance over Loch Ness. All the firs within about 200 yards of the factory are dead. This part of the country is past hope, but it is always worth while that the truth should be known.

But it is necessary to hear both sides of the question. A writer who has within the past few months paid two visits to Foyers paints a very different picture. In an article in a well-known Glasgow paper he says:—

Our first visit to the Falls this year was in the month of April. We had heard so much about their disappearance that we were agreeably surprised by their splendid volume—the brown water of the mountain stream tumbling over the majestic Lower Fall with a grandeur we had seldom witnessed. At this time the works of the Aluminium Company were in full progress—a fact which shows that the water withdrawn for the motive power had not any perceptible effect upon the Falls. Our second visit to Foyers was last week. Owing to the drought of the previous month—we were told that there was very little rain during that time in the district—the Falls were not in the effective volume we had seen in April; but still there was a pretty and effective flow of water. In former years this has been a frequent experience in the middle of summer. The Falls are quickly affected by a long continued drought, and a heavy fall of rain at once changes the aspect of the principal Lower Fall. The proportion of water the company withdraw for their works does not affect the Falls to any serious extent. On the occasion of our visit in April we took up our position on the ledge of rock fronting the Fall, but owing to the misty spray descending in showers we were unable to remain for any length of time. On our second visit there was no spray owing to the greatly lessened flow of water. It was stated in the letter recently published that all firs within about 200 yards of the factory are dead. There is no doubt that a large number of the spruce firs within close proximity to the works are to all intents and purposes dead. The forester informed the writer that the decay of the spruce firs has been proceeding within the past two years, but whether this fact is due to the works or otherwise he is unable to say. He observes that spruce firs about three or four miles above the works are similarly affected. He mentioned as a peculiar coincidence that he had recently observed spruce firs in the neighbourhood of Inverness also decaying. All the other trees in proximity to the factory, including the birches, are in splendid foliage, and with the exception of the bareness of the spruce firs, there is nothing to detract from the wooded appearance of the surroundings of the factory. On the face of the steep hill, in which the pipe tracks are laid, many trees had to be cut down, which somewhat affects the picturesqueness of the hill; but this was unavoidable on account of the nature of the work necessary to be carried out in connection with the operations of the company. There are at present 200 men employed by the company, while about 50 men are engaged by the Acetylene Company. The work of the British Aluminium Company has been successfully conducted, and there is every indication that it will continue to prosper. Many of the native population, including the crofters, have greatly benefited by the steady employment obtained from the Aluminium Company, and a new era has undoubtedly dawned upon the district.

We think these remarks go to prove that while the British Aluminium Company is building up a capital business, which is benefiting the locality to an enormous extent, its operations are not having that disastrous effect upon the beautiful Falls which some would lead us to believe.

Chloride of Silver Cells.—A form of this cell is being introduced by the Chloride of Silver Dry Cell Battery Company, of America. It is stated that the cells are being largely used in the States by electric light, telephone, and tramway companies for testing purposes. The cells are made 1 inch in diameter, and 3 inches long, in a brass tube, and each weighs about 2 ozs. A cell is said to have a life of 700 hours, and to give a constant electromotive force of 1 volt. What special advantage these cells possess over the ordinary dry cell type is not evident, as their E.M.F. is low.

Instruction by Correspondence.—Instruction by correspondence seems to be very successful in America. Probably one reason for this is, that though educational facilities are abundant, distances are so great that a large proportion of people must always reside outside their reach. Hence the success of correspondence methods. One such is the Electrical Engineer Institute of Correspondence Instruction, which numbers among its teaching staff such men as Prof. F. B. Crocker, of Columbia University, C. F. Scott, chief electrician of the Westinghouse Electric and Manufacturing Company, Elmer G. Willyoung, the electrical instrument expert; W. Maver, jun., the telegraphic expert; W. Maver, jun.; and Thorburn Reid. It is found that workmen, apprentices, employers, and officials all become enrolled as students. The *Electrical Engineer* (New York), from which we cull the above information, speaks very appreciatively of the Institute and its success in teaching.

Electrical Governor for Marine Engines.—To prevent the engines of a vessel from racing when the screw rises above the water, Sig. E. Putalo has invented an electrical regulator. It consists, according to *Industries and Iron*, of two vessels of mercury, connected at the bottom by a tube, and mounted fore and aft in the ship. The vessels are about half full at normal depth. When the ship pitches forward so as to raise the screw, the rods connected with the resistance are submerged one after the other so that an electro-magnet is brought into play, the whole resistance being short-circuited when the screw is quite out of the water. The electro-magnet operates a throttle valve in the main steam pipe, which is thrown open by another magnet. By this arrangement the steam is turned off and on. From experiments it has been shown that the mercury vessels need not be more than 34 inches apart on a ship 300 feet long.

The Poisonous Action of Acetylene.—Since it has been repeatedly stated that leakages from acetylene generators and installations have no injurious effects upon people who inhale them, it is worth while referring to a paper on the subject by U. Mosso and F. Ottolenghi, *vide Ann. di Chim. e di Farmacol*, xxv., 163. The authors have studied the poisonous action of mixtures of acetylene and air. Small amounts of acetylene are dangerous to animals. Inspiration of ½ litre of the pure gas poisons dogs in a few seconds, and powerful artificial respiration is needed to restore them. A 20 per cent. mixture of acetylene and air kills dogs in an hour or less; the disturbance to the system is so great in these slow actions, that the dogs often die after they have been brought into fresh air, and have apparently recovered. Large amounts of the gas affect the respiration; smaller quantities produce irritation, followed by a period of paralysis and weakening of the heart and lungs.

Multiphase Plant for a Municipal Central Station.—We understand that the Corporation of Manchester have lately placed a large order for three-phase machinery with Messrs. Thomas Richardson & Sons, of Hartlepool, and Messrs. Brown, Boveri & Co., of Baden, Switzerland. The order comprises rotary converters of an aggregate capacity of 1,200 units, with three-phase static transformers of the same output, and also the necessary high and low tension switchboards for the control and regulation of the above. This machinery is required for the supply of electrical energy from the municipal electric lighting station in Dickinson Street to various outlying urban districts. Continuous current will be taken from the omnibus bars of the central station switchboard and transformed by means of the rotary and static transformers to three-phase current at a tension of about 5,000 volts. This will be distributed by means of high tension triple conductor cables to the different substations, where it will again be converted into continuous current, and be distributed to the consumers on the three-wire system with 400 volts between the outers.

Marriage.—Mr. A. S. Barnard, the borough electrical engineer of Hull, was married on Wednesday, 10th inst., at Platt Chapel, Manchester, to Miss Muriel Marles-Thomas, B.A., youngest daughter of the late Rev. Wm. Thomas (Gwillym Marles) of Llandyssul. The ceremony was performed by Rev. J. C. Street, of Shrewsbury. The happy couple are spending their honeymoon in North Wales.

America and Her New Possessions.—Having freed Cuba from the grip of the Spanish incubus, America turns her searchlights upon the business outlook, to see wherein she will be rewarded for her valour. Our New York electrical contemporaries, ever on the alert for new business, have caught the general infection. That there will be a great increase in American trade with the Philippines is certain, whether the occupation be partial or complete, temporary or permanent. The islands will, on the other hand, benefit to an enormous extent by the introduction of the appliances of civilisation which have so far been withheld by oppression and bad management. "What will be the effect upon the electrical trade?" That is the question which presents itself to the mind of the editor of the *Electrical World*. Further, "What class of manufacturers will most likely be required?" Both are matters of great moment to the American trader, and of consequent interest to ourselves as well. Therefore we quote some of our contemporary's remarks, as follow:—

> Probably the largest demand will be for telephone and telegraph apparatus and supplies, and electric light machinery. If the coffee, tobacco, hemp, and sugar industries are to be systematised in proper American fashion, there will no doubt be a considerable demand for motor-driven machinery. Among the smaller articles that will find a ready sale will be fans of all kinds. To this day the problem of an efficient mechanical or electrical substitute for the punkah coolie—the man who pulls the string that works the flapping fans that make night endurable in India—has not been solved. The difficulty with the human machine is that it sleeps, under which circumstances its employer wakes. While punkahs do not at present seem to be the fashion in the Philippines, it is unquestionable that the exigencies of one of the hottest climates on the globe require some sort of air-cooling or moving mechanism, and our enterprising fan manufacturers should be on the alert. The conditions on the vast sugar and tobacco estates in Cuba seem to be especially favourable for the use of a system of electric transmission. Many of these plantations operate railways for the hauling of the cane, &c, and much machinery is used even now in the various stages of the sugar industry. Under different conditions there is no doubt that this industry will be managed in a more progressive manner, and that it will be a field for profitable extension of electrical methods. There is not a single line of electric railway in Cuba, though it has four cities of over 50,000 population. There were, before the outbreak of the recent insurrection, about 3,000 miles of telegraph lines in the island, and about 1,000 miles of railway, a good deal of the latter being narrow gauge road on the sugar estates.

America is, like ourselves, pledged to the policy of the "open door." Such principles, it may therefore be taken for granted, will govern all her dealings in these markets. Owing to her extensive knowledge of the principal characteristics of the islands, and particularly of Cuba, she will stand a good chance against competition. But the market will be open, and British firms will doubtless be there to get a share in whatever is going.

The War and the Cuba Submarine Telegraph Company, Limited.—The following note, signed by Jas. Scott, secretary, has been sent out to the shareholders:—"I am instructed to inform you that, owing to the war in Cuba, which has prevented the returns being sent home, it will not be possible to make up the accounts for the half-year to June 30th for presentation to the shareholders at the usual time this month, and the meeting will, therefore, be postponed until later in the year, due notice of which will be given to the shareholders. The directors regret to state that the operations of the war have caused considerable damage to the company's cables and property, but they are unable at present to estimate the extent thereof."

Municipal Works.—Sir J. W. Maclure has given notice to move for a return of the water, gas, tramway, electric lighting, and "other unproductive undertakings," carried on by municipal boroughs. He asks that the return shall set out the date at which the corporation commenced working; the amount of the capital provided by the corporation, and the amount borrowed, the amount paid off and now outstanding, the average annual income and working expenses for the last five years, the annual net loss, the amount set apart for depreciation, and the mode in which the annual net loss has been provided for.

Personal.—Mr. Edgar Hesketh, late of the British Insulated Wire Company, has been appointed chief assistant engineer to the Folkestone Electricity Supply Company, Limited.

Ozone and Ozonised Air.—We have been favoured by Colonel Engledue, of the Commercial Ozone Syndicate, with a report of Mr. J. Lewkowitsch on the patent processes for improvements in the fat and oil industries owned by the Commercial Oxone Syndicate, which refers more especially to an atomising apparatus and to resinates linofeates, the well-known compounds usually known as driers. But we are more interested in the cost of ozone than in the applications of these improved chemicals to oils. Mr. Lewkowitsch is quite right when he says that the question of economical working on a large scale would thus resolve itself chiefly into the question of the cost of producing oxone. According to his calculations, 15,000 cubic feet of ozonised air cost—

12d. for blowing the air,
3d. for electrical energy,
2d. for depreciation.

Total 17d.

This statement about 15,000 cubic feet of ozonised air does not tell us the quantity of ozone produced by the Board of Trade unit. Mr. Lewkowitsch adds that 1 ton of oil could require about 11,000 cubic feet of ozone, costing 11d., or, say, 1s. per ton. If there were an ozoniser capable of producing 11,000 cubic feet of ozone for 11d., this would be much more marvellous than the miracle of the 11,000 virgins of Cologne. But evidently Mr. Lewkowitsch speaks of 11,000 cubic feet of ozonised air for 11d., which makes 1d. per 1,000 cubic feet. But how much ozone is contained in 1,000 cubic feet of ozonised air?

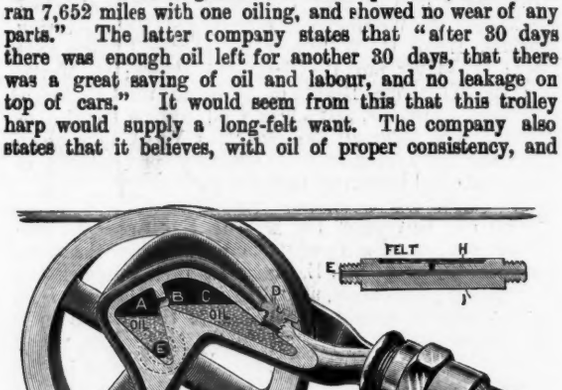
The Zipernowski Patent Litigation.—From various paragraphs in our "Electric Lighting Notes" this week it will be seen that Mr. Martin Rucker's syndicate and solicitors have communicated with a number of the municipal authorities, making claims for the infringement of the Zipernowski and Deri patents, to which we referred last week. Various paragraphs relating to the position of affairs have appeared in the daily and weekly papers, and the following from the *Critic* is about the best statement of all:—

> That was a more than usually silly story which sent a shiver through the Electric share market the other day. It was stated that Mr. Martin D. Rucker intended proceeding against some 50 electric light undertakings for infringement of a patent which he has recently acquired. If, as is said, the patent in question was issued in 1884, it will expire this year; and it is inconceivable that it could have come into such general use without those interested becoming aware of the fact long ago. Under the circumstances, it is extremely doubtful whether the Courts would entertain a claim for damages, which in any case could hardly be made retrospective prior to notice of the infringement being given. Either Mr. Martin D. Rucker or the market has been badly hoaxed over it, I should think. However, we shall soon find out more about it if it is true that a test case is to be brought against the London Electric Supply Corporation.

A conference of corporations and vestries, who are members of the Municipal Electrical Association, was held last Friday afternoon at the Westminster Palace Hotel, under the presidency of Mr. A. H. Gibbings, of Bradford, to consider their course of procedure with reference to the action against the London Electric Supply Corporation. Some 50 corporations and other bodies throughout the country are concerned, and it is understood that if the present test action is successful, proceedings will be taken against each of the other local authorities whose systems are considered to infringe the patents. Representatives were present from Blackpool, Huddersfield, Bolton, Halifax, and South Shields. The proceedings were conducted in private, but it was officially stated that a resolution was passed agreeing to combine to assist the London Electric Supply Corporation in defending the action being taken by Mr. Rucker, and, if necessary, to carry the case to the House of Lords. A sub-committee was appointed to follow the matter up.

Obituary.—Mr. T. Sopwith, M.I.C.E., F.G.S., of T. Sopwith & Co., died on July 30th, at the age of 60 years. Mr. Sopwith had been connected with important lead mines in Spain for many years. He had written various papers on lead and copper and other scientific subjects, but he was known to the electrical industry more particularly as a large supplier of lead for covered cables.

Excelsior Self-Oiling Trolley Harp.—The illustration given below, from the *Street Railway Review*, shows an improvement in trolley harps. The manufacturers state that this harp has been adopted by the Rapid Railway Company, the Mt. Clemens Fast Line, and the Sandwich, Windsor and Amherstburg Railway, after a trial of 30 days. The former company states that "it was used on one of the fast cars having two 75-H.P. motors geared to 50 miles per hour, and that it ran 7,652 miles with one oiling, and showed no wear of any parts." The latter company states that "after 30 days there was enough oil left for another 30 days, that there was a great saving of oil and labour, and no leakage on top of cars." It would seem from this that this trolley harp would supply a long-felt want. The company also states that it believes, with oil of proper consistency, and



with axles ¾ inch. to ⅞ inch in diameter, they will run 60 days with one oiling; it considers the axle at present used, ½ inch in diameter for a 6-inch wheel, too small for the best results. It is prepared to make quotations on harp, wheels and bushings, complete or separately, also to supply harps with larger axles and bushings. Referring to the cut, each side of harp holds 1 ounce of oil. C is the main reservoir; A, the auxiliary reservoir; D, filler plug; E, feed to axle; H, felt to prevent rapid flow of oil; B, passageway through which oil passes to auxiliary reservoir when trolley is reversed at the end of a trip. After long use the harp can be blown out with steam and cleaned, by simply taking apart and blowing a jet of steam through the filler plug, D. Any further information will be cheerfully given by the maker, the International Specialty Company, 113, 7th Street, Detroit, Mich.

Aluminium as an Electrode.—At a recent meeting of the American Chemical Society, G. J. Hough states that aluminium may be safely used as a substitute for platinum for cathodes with solutions of nitric acid, oxalates, or cyanides, but not with solutions of sulphates or chlorides. It cannot, however, be used for anodes. Although commercial aluminium cathodes very gradually lose in weight, they may with great advantage be employed, especially for copper determinations. Besides being cheaper, the deposited copper is more readily removed from them, and the weight of the electrode is less out of proportion to that of the deposit than is the case with platinum. For further details consult the *Journal of the American Chemical Society*, 1898, XX., (4), 302.

Fatal Accident—Not Electrical.—If an accident occurs in any works where some electrical machinery is employed, the daily press is almost bound to say that electricity was the cause of the mishap. Electricity is in this way blamed for many sins which it has never committed. During the present week the London dailies have been publishing under the heading "Killed by Electricity," some notes on a fatality which occurred on Saturday morning last at the Llanelly Steel Works. The actual facts are, that a youth named Protheroe was leaning over one of the outside stays of an American "Wellman" charging machine when the rise and fall motion was put into operation, and the descending arm caught him at the back of the neck, killing him instantly. The inquest has been adjourned until 22nd inst. for the attendance of the factory inspector, who is now away on his holidays.

Appointments Vacant.—The Derby Corporation is advertising for an electrical engineer and manager for the electricity works, at £350 per annum. See our "Official Notices" this week.

The Greenock Electric Lighting Committee, after inspecting municipal electric lighting plants in several Scotch towns, has decided to advertise for a resident electrical engineer at £300 per annum, to design works and draw up a plan of the district proposed to be lighted.

The Watford District Council want an electrical engineer for the new lighting station at £150 per annum. See our "Official Notices."

Explosion at Oldham. — According to last night's evening papers there was a violent explosion late on Wednesday night, caused through an accumulation of gas in the electric light culverts. The pavement was torn up and several persons were shaken.

Appointment. — At a meeting of the Wolverhampton Electric Lighting Committee on Monday, Mr. Herbert Vickers, who has been for two years at the Bolton electricity works, was, out of a host of applicants, selected for appointment as junior assistant electrical engineer under the Wolverhampton Corporation.

Como Exhibition of Electric Appliances, 1899.—The Department of Science and Art has received information, through the Foreign Office, of an exhibition of electric appliances to be held in Como next year in commemoration of the centenary of Volta's discovery of the electric pile. We made this information public in the ELECTRICAL REVIEW for July 1st!

NEW COMPANIES REGISTERED.

Howell's "Simplex" Anti-Inductive Telephone Syndicate, Limited (58,416).—This company was registered on July 30th, with a capital of £12,000 in 11,950 shares of £1 and 1,000 deferred shares of 1s. each, to acquire certain British patents and rights for improvements in telephones, to adopt an agreement with J. G. Macintosh, and to carry on the business of electricians, mechanical engineers, and suppliers of electricity. The subscribers (with five shares each) are:—Miss E. J. Holding, 26, Acris Street, Wandsworth, S.W.; C. Spurge, 55, Hatherley Road, Walthamstow, clerk; F. H. Suckling, 15, Hargrave Road, Holloway, N., clerk; G. N. Jones, 50, Fairholt Road, Stoke Newington, secretary; R. A. Webster, 8, Melton Road, Stoke Newington, gentleman; W. J. Wilcox, 33, Farnley Road, South Norwood, manager; E. Sorrell, 50, Ismiston Road, Stratford, E., clerk. The number of directors is not to be less than two nor more than seven; the subscribers are to appoint the first; qualification, 100 shares; remuneration, £100 each per annum. Registered office, 55 and 56, Bishopsgate Street Within, London, E.C.

Electrical Thawing Syndicate, Limited (58,429).—This company was registered on August 2nd, with a capital of £25,000 in £1 shares, to acquire, own, and work any patents and rights, and to carry on the business of electricians, electrical and mechanical engineers, suppliers of electricity, and electrical apparatus manufacturers. The subscribers (with one share each) are:—W. Ellwood, 4, Marlborough Villas, Peckham, S.E., accountant; J. L. Cooper, 6, Union Road, Tufnell Park, N., accountant; A. E. Seamer, 7, Park Place Villas, W., clerk; J. L. Lobb, 63, Godolphin Road, W., solicitor; E. W. Piper, 17, Eglinton Road, Bow, E., accountant; E. G. Lovell, 21, Isledon Road, Holloway, N., clerk; and J. J. Lunniss, 11, Queen Victoria Street, E.C., clerk. The number of directors is not to be less than three nor more than seven; the subscribers are to appoint the first; qualification, £100; remuneration as fixed by the company.

Mackey's Electric Lamp Company, Limited (58,437).—This company was registered on August 3rd, with a capital of £2,000 in £1 shares, to adopt an agreement with J. A. D. Mackey, and to carry on the business of incandescent lamp manufacturers and electrical engineers. The subscribers (with one share each) are:—J. A. D. Mackey, 26, Sussex Gardens, W., lamp manufacturer; Miss A. E. Cooper, 26, Sussex Gardens, W.; R. Mullard, 175, Grange Road, S.E., chemist; C. P. Tregellas, 17, Macaulay Road, Clapham Common, chemist; N. Smith, 12, Chesterfield Street, W.C., electrical engineer; E. E. Probert, 75, Coleman Street, E.C, accountant; J. P. Nurse, 102, East Dulwich Road, S.E., clerk. The number of directors is not to be less than three nor more than seven. The first are J. A. D. Mackey (chairman), R. Millard, and C. P. Tregellas; remuneration, £200 each per annum, and £300 for the chairman.

Manuscriptor Syndicate, Limited (58,451).—This company was registered on August 3rd, with a capital of £10,000 in £1 shares, to adopt an agreement with the International Telescriptor Syndicate, Limited, to carry on the business of a manuscriptor, velocriptor, telephone, and telegraph company, and to establish, work, manage, control, and regulate electric recording systems. The subscribers (with one share each) are:—S. H. Bannister, 50, Wrotham Road, Camden Town, clerk; S. G. Fitness, 11, Lansdowne Road, Clapham, S.W., clerk; M. Lawrence, 18, West Street, Pimlico, S.W., clerk; J. V. Gray, 28, Squarry Street, Lower Tooting, S.W., clerk; F. J. Moore, 29, The Avenue, Ealing Dean, W., clerk; A. J. R. McVeagh, 86, Wood Vale, Forest Hill, S E, clerk; M. A. Robertson, 73, Hugh Street, S.W., law student. The regulations of Table "A." in most cases apply.

Freudenberg's Automatic Telephone Syndicate, Limited (58,452).—This company was registered on August 3rd, with a capital of £10,000 in £1 shares, to acquire the patents and rights for the whole world relating to telephonic apparatus and to telephone machines, and to carry on the business of a telephone, telescriptor, velocriptor and telegraph company. The subscribers (with one share each) are:—M. A. Robertson, 73, Hugh Street, S.W., law student; M. Lawrence, 18, West Street, Pimlico, S.W., clerk; G. T. Barnett, 30, Crown Terrace, Richmond, S.W., clerk; F. S. Wild, 9, Beauchamp Road, East Molesey, clerk; H. Morgan, 30, Bramerton Street, Chelsea, S.W., clerk; A. J. R. McVeagh, 96, Wood Vale, Forest Hill, S.E, clerk; S. G. Fitness, 11, Lansdowne Road, Clapham, S.W., clerk. The number of directors is not to be less than three nor more than eight; the first are to be nominated by the subscribers; qualification, one share; remuneration, £100 each per annum, and 2½ per cent. of the net profits, divisible.

Freudenberg's Multiple Telephone Syndicate, Limited (58,453).—This company was registered on August 3rd with a capital of £10,000 in £1 shares, to acquire the patents and rights of Moise Freudenberg for the whole world relating to telephonic apparatus and to telephone machines, and to carry on the business of a telephone, telescriptor, velocriptor, and telegraph company. The subscribers (with one share each) are:—M. A. Robertson, 73, Hugh Street, S.W., law student; M. Lawrence, 18, West Street, Pimlico, S.W., clerk; G. T. Barnett, 30, Crown Terrace, Richmond, S.W., clerk; F. S. Wild, 9, Beauchamp Road, East Molesey, clerk; H. Morgan, 30, Bramerton Street, Chelsea, clerk; A. J. R. McVeagh, 96, Wood Vale, Forest Hill, S.E, clerk; S. G. Fitness, 11, Lansdowne Road, Clapham, clerk. The number of directors is not to be less than three nor more than eight; the first are to be nominated by the subscribers; qualification one share; remuneration, £100 each per annum, and 2½ per cent. of the net profits, divisible.

Compound Hydro-Carbon Motor Syndicate, Limited (58,466).—This company was registered on August 4th, with a capital of £12,000 in £1 shares, to acquire the business of motor and motor-car manufacturers, carried on by John Holroyd, Edmund Wiseman, and Christopher T. Wordsworth, at Luton, Beds., and to manufacture, sell, and deal in oil, gas, steam, and electric motors, motor-cars, and cycles of all kinds. The subscribers (with one share each) are:—E. Wiseman, Cheapside, Luton, engineer; J. Holroyd, 13, Alleyn Terrace, West Dulwich, engineer; C. T. Wordsworth, 5, John Street, Luton, engineer; E. Bargwanath, 22, Cardiff Road, Luton, draughtsman; S. Weatherland, 29, Cardiff Road, Luton, merchant; A. Shiell, 117, Leadenhall Street, E.C., merchant; and J. Alexander, 51, Constantine Road, Hampstead, clerk. The number of directors is not to be less than three nor more than five; the first are J. Holroyd, E. Wiseman, and J. Tearle; qualification, £100; remuneration as fixed by the company.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Thomas Parker, Limited (40,973).—This company's annual return was filed on July 20th, when the whole capital of £75,000 in £10 shares was taken up. 1,750 shares are considered as paid, and £57,500 has been received on the others.

Electric and General Investment Company, Limited (31,506).—This company's annual return was filed on July 15th. The capital is £200,000 in £5 shares (100 founders'), of which 20,000 ordinary and 100 founders' have been taken up. £1 per share has been called on the former, and £5 per share on the others, and £20,500 has been paid.

African Direct Telegraph Company, Limited (21,895). This company's annual return was filed on June 11th, when 23,600 shares were taken up out of a capital of £300,000, in £10 shares, and paid for in full.

Edmundsons' Electricity Corporation, Limited (52,013).—This company's annual return was filed on July 28th. The capital is £200,000 in £5 shares (4,500 deferred). 26,100 ordinary and 4,500 deferred shares have been taken up, and 8,700 of the former and all the latter are considered as fully paid. £4 per share has been called on 17,400 ordinary, and £69,600 has been received.

United River Plate Telephone Company, Limited (23,654).—This company's annual return was filed on July 27th, when 56,000 shares were taken up out of a capital of £500,000, in £5 shares. 16,000 are considered as paid, and £210,000 has been paid on the others.

CITY NOTES.

Liverpool Overhead Railway Company.

The twentieth half-yearly ordinary general meeting of the Liverpool Overhead Railway Company was held on Tuesday, 9th inst., at the Law Association's rooms, Liverpool.

Sir Wm. Forwood, chairman of the company, who presided, in moving the adoption of the report, congratulated the shareholders on the satisfactory condition of the business during the past six months. In that period they had carried 4,473,000 passengers, and in the past 12 months the passengers numbered nearly nine millions, or an increase of 753,000 as compared with the preceding 12 months. This improvement had been general. There was first of all an improvement in what he might call the regular business of the line—the traffic connected with the docks. The line, indeed, was a sort of barometer of the trade of the port. When the docks were busy the traffic on the railway was good, and if the docks were idle the railway traffic fell down. But not only had they maintained and increased the general traffic, but the excursion traffic was still in a very satisfactory state. When the line was first proposed it was considered that the excursion traffic was a matter that would last one or two seasons and then disappear; but last week was a record week in that respect when they carried 238,000 passengers, with a resulting income of £2,070. On Bank Holiday alone 66,000 passengers passed along this little line. That would prove that the railway was not only serving the trade of the port well, but that it was still very popular with visitors to the city. The receipts for the half-year amounted to £37,220, an increase of £1,195 over the same half of last year. The working expenses were also larger by £1,100. The increased expenditure was almost entirely due to the increased cost of labour, and also to the renewal of some of the storage batteries. On all the large railways there had been an increase of expenses during the past six months. They were always trying to keep the expenses down, but they must have on such a line efficiency before economy. They must not forget that the line runs over six miles of iron viaduct, and that they maintained no fewer than 17 stations. He could say with confidence that to-day the line was in a better condition than on the first day it was opened; and he thought the money they had expended in its maintenance had been wisely expended in the interests of the shareholders. The grand result of the half-year's working was that they recommended the same dividend as in the corresponding half of last year, and also carried forward £998 more than last half-year. The expenditure per train mile worked out at 15·47d., against 15·65d. in the previous six months, and 15·03d. in the corresponding half of last year. So they would see that the expenditure had gone up a little less than a half-penny per train mile during the half-year, from the causes he had stated. The revenue per train mile was 24·63d., against 24·25d. last half-year. The electrical expense per train mile was 3·93d., against 3·71d. last half-year. In order to improve the lighting of the trains, they had added a new electrical machine, called the Booster machine, for the purpose of regulating the current. It was answering the purpose so well that they had ordered a second booster, and when they had it he hoped there would be no cause for complaint about the lighting of the carriages. The line was carried on in such a way that he did not think there was any railway in the kingdom working so regularly. As to the future, all he could say was, that if they believed in the trade of the port continuing—and he believed there was a great future before it—then they must also believe in the success of the railway. They were every day improving their position. The Corporation electrical tramways which come into competition with their single station when they first commenced to run, but he had no doubt in the end the railway would benefit from them.

Mr. Edward Lawrence seconded the motion, which was carried.

On the proposition of the Chairman, it was resolved to pay the usual dividend of 5 per cent. per annum on the preference shares for the half-year, and 3 per cent. per annum on the ordinary shares for the same period.

The proceedings terminated with a vote of thanks to the chairman.

Waterloo and City Railway Company.

The ninth half-yearly meeting of the shareholders of this railway was held on Thursday of last week at Waterloo, Mr. W. S. Portal presiding.

The Chairman, in moving the adoption of the report, after referring with regret to the loss the company had sustained in the death of one of the directors—the late Mr. A. Guest—said he regretted exceedingly that there should have been such an unfortunate delay in the completion and opening of the railway. They had hoped, as he stated at the last meeting, that long before this the line would have been in full work, but that had not been possible, and consequently they were unable to declare any dividend because they had no revenue receipts, and they had exhausted the whole of the money payable in interest during the construction of the railway. The report of the engineers, as follows, really explained the whole situation:—"The works of the railway, together with the stations and signals, have been examined and passed by the inspecting officer of the Board of Trade. Pending the completion of the main subways by the Central London Railway Company, two temporary staircases for passengers arriving at and departing from this company's City station have been constructed. The electrical equipment has been much delayed, owing, it is stated by the contractors, to the strike in the engineering trade, which lasted several months. In consequence of this delay it has been found impossible to get the rolling stock in proper working order and make the necessary trials within the time contemplated when the contracts were let. The whole of the boilers, however, have now been fixed in the generating station, and are in working order, together with all the electrical apparatus, including five out of the six steam engines and dynamos. For the working of the railway four trains are necessary, and a fifth complete train, with one or two spare carriages, will be held in reserve. The whole of the carriages (including the motors) have been delivered for five trains. Four trains are ready, and the fifth is nearly complete. The experimental running of the trains has been commenced, and we are pleased to state that the heavy permanent way which has been adopted, has proved most satisfactory, and that the rolling stock runs smoothly round all the curves, even at high velocity. The power provided at the generating station, and the capacity of the motors on the trains, have been found amply sufficient to fulfil all the specified conditions." As that report stated everything was ready, but they wanted to have the trains thoroughly tested before they could tell the public that they could travel by the line without the danger of any hitch occurring. He really believed it would be opened for traffic on Monday next, although he could not confidently say that it would. He believed the contractors had done their best under all the circumstances of the case. As they were probably aware the Duke of Cambridge formally opened the line on July 11th, and everybody present on the occasion expressed approval of the undertaking. Nearly the whole of their shares had been converted into stock, and at present they had only 80 shares outstanding, and those he believed would come in before the next meeting. He congratulated the proprietors that they were at last on the eve of the opening of the railway, and expressed the hope that at the next meeting he would be able to submit a favourable account and declare a fairly satisfactory dividend.

Col. Campbell seconded the motion, and the report was adopted.

Brazilian Telegraph Agreements.

Yesterday (Thursday) meetings of the Brazilian Submarine Telegraph Company (presided over by Mr. J. D. Pender), the Western and Brazilian Telegraph Company (presided over by Mr. W. S. Andrews), and the London Platino-Brazilian Telegraph Company (presided over by Mr. Andrews), were held for the purpose of confirming resolutions already passed for the joint working of the undertakings. The details of the scheme have already been dealt with fully in the Electrical Review. In each case the resolutions were confirmed.

Stock Exchange Notices.—Application has been made to the Stock Exchange Committee to appoint a special settling day and to grant a quotation to:—Eastern Telegraph Company, Limited—Provisional certificates for £500,000 3½ per cent. preference stock.

Hampstead Electric Supply Company. — The final batch of letters of allotment for the preference and ordinary shares was posted at the end of last week.

Volenite, Limited.—The statutory meeting of this company was held on Monday at Winchester House, Old Broad Street, E.C., Lord Lurgan presiding.

Monte Video Telephone Company.—A meeting of this company was held on Wednesday at Winchester House.

TRAFFIC RECEIPTS.

The Bristol Tramways and Carriage Company, Limited.—The receipts for the week ending August 5th, 1898, were £3,981 18s. 5d.; corresponding period 1897, £3,562 9s. 6d.; increase, £419 8s. 11d.

The City and South London Railway Company.—The receipts for the week ending August 7th, 1898, were £1,105; week ending August 8th, 1897, £939; increase, £166; total receipts for half-year, 1898, £5,862; corresponding period, 1897, £5,456; increase, £406. Mileage open, 3⅝ miles.

The Dover Corporation Electric Tramways.—The receipts for the week ending August 6th, 1898, were £272 12s. 7d.; total receipts to August 6th, 1898, £4,311 13s. 10d.

The Dublin Southern District (Electric) Tramways Company.—The receipts for the week ending August 5th, 1898, were £1,316 13s. 11d. (includes traffic from Haddington Road to D'Olier Street); corresponding week last year, £1,153 11s. 4d.; increase, £163 2s. 7d.; passengers carried, 170,373; corresponding week last year, 153,479; aggregate to date, £5,648 14s. 11d.; aggregate to date last year, £4,594 17s. 3d.; increase to date, £1,053 17s. 8d.; mileage open, 9 miles, as against 8 miles for the corresponding period of last year.

The Liverpool Overhead Railway Company.—The receipts for the week ending August 7th, 1898, amounted to £2,007; corresponding week last year, £1,781; increase, £226.

The Western and Brazilian Telegraph Company, Limited.—The receipts for the week ending August 5th, 1898, after deducting 17 per cent. of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited, were £2,753.

SHARE LIST OF ELECTRICAL COMPANIES.—TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1895.	1896.	1897.	Closing Quotation, August 3rd.	Closing Quotation, August 10th.	Business done during week ended August 10th, 1898. Highest.	Lowest.
137,400l	African Direct Telegraph, 4 % Debs.	100	4 %	...	...	100 —104	100 —104	...	...
25,000	Amazon Telegraph, shares	10	...	...	...	6 — 7	6 — 7	...	...
125,000	Do. do. 5 % Debs. Red.	100	...	...	...	92 — 95	92 — 95	...	...
923,960l	Anglo-American Telegraph	Stock	£2 9s	£2 13s	3 %	64 — 67	64 — 67	64	...
3,038,020l	Do. do. 6 % Pref.	Stock	£4 18s	£5 6s	6 %	115 —116	115 —116	116½	115⅞
3,038,020l	Do. do. Deferred...	Stock	...	...	...	15½— 16	15 — 15½	15¾	15⅝
130,000	Brazilian Submarine Telegraph	10	7 %	7 %	7 %	15¾— 16¼	15¾— 16¼	16 1/16	15 15/16
75,000l	Do. do. 5 % Debs. 2nd series, 1906 ...	100	5 %	...	...	111 —115	111 —115	...	...
44,000	Chili Telephone, Nos. 1 to 44,000	5	4 %	4 %	...	2⅜— 3¼	2⅜— 3¼	...	...
10,000,000$	Commercial Cable	$100	7 %	8 %	8 %	180 —190	180 —190	...	...
918,297l	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	...	...	...	103 —105	104 —106	104⅜	104
224,850	Consolidated Telephone Construction and Manufacturing	10/-	1½ %	2 %	...	1/16— 3/16	1/16— 3/16	...	...
16,000	Cuba Telegraph	10	8 %	8 %	7 %	7½— 8½	7 — 8	...	...
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	15½— 16½	15 — 16	15⅜	...
12,931	Direct Spanish Telegraph	5	4 %	4 %	4 %	4 — 5	4 — 5	...	...
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 — 11	10 — 11	...	...
30,000l	Do. do. 4½ % Debs., Nos. 1 to 6,000 ...	50	4½ %	4½ %	4½ %	102 —105%	102 —105%	...	...
60,710l	Direct United States Cable	20	2½ %	2½ %	...	11 — 11½	11 — 11½	11½	11 7/16
120,000	Direct West India Cable, 4½ % Reg. Deb.	100	...	...	...	100—103	100 —103	...	...
400,000	Eastern Telegraph, Nos. 1 to 400,000	10	6½ %	6½ %	7 %	17¼— 17⅜	17¼— 17⅜	17⅜	17¼
1,295,000	Do. 3½ % Pref. Stock	100	...	...	...	101 —105	101 —105	104	102¾
89,900	Do. 5 % Debs., repayable August, 1899 ...	100	5 %	5 %	5 %	100 —103 xd	100 —103	...	...
1,302,615l	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	4 %	4 %	123 —127	123 —127	126	124
250,000	Eastern Extension, Australasia, and China Telegraph ...	10	7 %	7 %	7 %	17¼— 17⅜	17¼— 17⅜	17⅝	...
25,200l	Do. 5 % (Aus. Gov. Sub.) Deb., 1900, red. ann. drgs., reg. 1—1,049, 3,976—4,326	100	5 %	5 %	5 %	99 —103	99 —103	...	...
100,500l	Do. do. Bearer, 1,050—3,975, 4,327—6,400	100	5 %	5 %	5 %	100 —103	100 —103	...	...
320,000l	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	123 —127	123 —127	125¼	...
35,100l	Eastern and South African Telegraph, 5 % Mort. Deb., 1900 red. ann. drgs., Reg. Nos. 1 to 2,343	100	5 %	5 %	...	99 —103	99 —103	...	...
46,500l	Do. do. do. to bearer, 2,344 to 5,500	100	5 %	5 %	...	100 —103	100 —103	...	...
300,000l	Do. 4 % Mort. Debs., Nos. 1 to 3,000, red. 1909	100	4 %	4 %	...	101 —104 xd	101 —104	...	...
200,000l	Do. 4% Reg. Mt. Debs. (Mauritius Sub.) 1—8,000	25	4 %	4 %	...	104 —107%	104 —107%	...	...
180,227	Globe Telegraph and Trust	10	4⅛ %	4½ %	4½ %	11½— 12	11¾— 12¼	11¾	11⅝
180,042	Do. do. 6 % Pref.	10	6 %	6 %	6 %	16½— 17	16¾— 17½	16⅞	16½
150,000	Great Northern Telegraph, of Copenhagen...	10	10 %	10 %	10 %	29 — 30	29 — 30	29½	...
160,000l	Do. do. do. do. 5 % Debs. ...	100	5 %	5 %	5 %	102 —105	102 —105	...	...
97,000	Halifax & Bermuda Cable, 4½ % 1st. Mt. Dbs., w'n. 1-1,200, rd.	100	...	...	...	99 —103	99 —103	...	...
17,000	Indo-European Telegraph	25	10 %	10 %	10 %	51 — 54	51 — 54	51¾	51
100,000l	London Platino-Brazilian Telegraph, 6 % Debs.	100	6 %	6 %	6 %	109 —112	109 —112	...	...
28,000	Montevideo Telephone, 6 % Pref., Nos. 1 to 28,000 ...	5	4 %	4 %	4 %	2¼— 2⅜	2¼— 2⅜	...	...
484,597	National Telephone, 1 to 484,597	5	5½ %	5½ %	6 %	5¾— 6 xd	5¼— 5½	5 1/16	5½
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	15 — 17	15 — 17	...	...
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	15 — 17	15 — 17	...	...
250,000	Do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	5 %	5⅛— 5⅜	5⅛— 5⅛	...	...
1,329,471l	Do. 3½ % Deb. Stock Red.	Stock	3½ %	3½ %	3½ %	100—105	100—105	103½	102½
171,504	Oriental Telephone and Elec., Nos. 1 to 171,504, fully paid	1	5 %	5 %	5 %	⅝— ¾	⅝— ¾	...	...
100,000l	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000 ...	100	4 %	4 %	4 %	105 —108	105 —108	...	...
11,839	Reuter's	8	5 %	5 %	5 %	8 — 9	8 — 9	...	...
3,381	Submarine Cables Trust	Cert.	...	...	...	136 —141	136 —141	...	...
58,000	United River Plate Telephone	5	4 %	5 %	6 %	4¼— 4⅜	4¼— 4⅜	...	...
146,733l	Do. do. 5 % Debs.	Stock	5 %	...	...	103 —106	103 —106	...	...
15,609	West African Telegraph, 7,501 to 23,109	10	4 %	nil	nil	3½— 4½	3½— 4½	...	...
213,400l	Do. do. 5 % Debs.	100	5 %	5 %	5 %	100 —103	100 —103	...	...
30,008	West Coast of America, Nos. 1—30,000 and 53,001—53,008	2½	...	...	...	¼— ⅜	¼— ⅜	...	...
150,000	Do. do. 4% Debs., 1—1,500 gua. by Braz. Sub. Tel.	100	...	...	...	103 —106	103 —106	...	...
64,269	Western and Brazilian Telegraph	15	3 %	2 %	3¼ %	12½— 13	12¼— 12⅜	12¼	12¼
33,129	Do. do. do. 5 % Pref. Ord.	7½	5 %	5 %	5 %	8½— 9	8 — 8½	8⅜	8⅛
33,129	Do. do. do. Def. Ord.	7½	1 %	nil	½ %	4 — 4½	4 — 4½	4 1/16	...
389,521	Do. do. do. 4 % Deb. Stock Red. ...	Stock	...	...	...	105 —108	105 —108	107½	107
88,321	West India and Panama Telegraph	10	⅛ %	1 %	¾ %	¾— 1	¾— 1	...	...
34,563	Do. do. do. 6 % Cum. 1st Pref. ...	10	6 %	6 %	6 %	8½— 9	8¾— 9¼	9¼	9
4,669	Do. do. do. 6 % Cum. 2nd Pref. ...	10	6 %	6 %	6 %	6 — 8	6 — 8	...	...
80,000l	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	104 —107	104 —107	...	...
1,163,000$	Western Union of U.S. Telegraph, 7 % 1st Mort. Bonds	$1000	7 %	7 %	7 %	105 —110	105 —110	...	...
160,100l	Do. do. do. 6 % Ster. Bonds ...	100	6 %	6 %	6 %	100 —105	100 —105	...	...

ELECTRICITY SUPPLY COMPANIES.

30,000	Charing Cross and Strand Electricity Supply	5	5 %	6 %	7 %	12½— 13½	12 — 13	12¼	...
20,000	Do. do. do. do. 4½ % Cum. Pref.	5	...	...	...	5⅝— 6¼	5⅝— 6¼	6¼	...
26,000	*Chelsea Electricity Supply, Ord., Nos. 1 to 10,277... ...	5	5 %	5 %	6 %	9 — 10	9 — 10	9¾	...
60,000	Do. do. do. 4½ % Deb. Stock Red....	Stock	4½ %	4½ %	4½ %	113 —115	113 —115	...	...
50,000	City of London Electric Lighting, Ord. 40,001—90,000 ...	10	5 %	7 %	10 %	24½— 25½	24½— 25½	25½	...
10,000	Do. Prov. Certs. Nos. 90,001 to 100,000 £5 ...	10	...	...	...	25½— 26½	24½— 25½	...	...
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	16½— 17½	16½— 17½	16⅝	16½
400,000	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	5 %	5 %	5 %	125 — 130	125 —130	128	125½
30,000	County of Lond. & Brush Prov. Elec. Ltg., Ord. 1—30,000	10	nil	nil	nil	13 — 14	13 — 14	...	...
10,000	Do. do. do. Nos. 30,001 to 40,000 £6 paid.	10	...	...	...	9½— 10½	8½— 9½	...	...
20,000	Do. do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	14 — 15	14 — 15	14½	...
17,400	Edmundsons Elec. Corp., Ord. Shares 1—17,400 £6 paid	5	...	...	...	4 — 5	4 — 4½	...	...
10,000	House-to-House Electric Light Supply, Ord., 101 to 10,100	5	...	...	4 %	9 — 10 xd	8½— 9½	9½	9 1/16
10,000	Do. do. 7 % Cum. Pref. ...	5	7 %	7 %	7 %	9½— 10¼xd	9½— 10½	9⅝	...
62,400	*Metropolitan Electric Supply, 101 to 62,500	10	4 %	5 %	6 %	16 — 17	15½— 16½	16½	16
220,000l	Do. 4½ % First Mortgage Debenture Stock	...	4½ %	4½ %	4½ %	116 —120	116 —120	...	...
6,452	Notting Hill Electric Lighting	10	2 %	4 %	6 %	15 — 16	15 — 16	15½	15⅝
31,980	*St. James's and Pall Mall Electric Light, Ord.	5	7½ %	10½ %	14½ %	16½— 17½xd	16 — 17	16⅝	16⅜
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	9 — 10 xd	9 — 10	...	...
50,000	Do. do. 4 % Deb. Stock Red. ...	Stock	...	...	4 %	105 —108	105 —108	...	...
43,341	South London Electricity Supply, Ord., £2 paid	5	...	...	...	3 — 3½	3 — 3½	3 3/16	3⅛
79,900	Westminster Electric Supply, Ord., 101 to 80,000 ...	5	7 %	9 %	12 %	15½— 16½	15 — 16	15⅝	15½

* Subject to Founder's Shares.
‡ Unless otherwise stated all shares are fully paid.
† Quotations on Liverpool Stock Exchange.
‖ Dividends paid in deferred share warrants, profits being used as capital.
Dividends marked ‖ are for a year consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1895.	1896.	1897.	Closing Quotation August 3rd.	Closing Quotation August 10th.	Business done during week ended Aug. 10th, 1898. Highest.	Lowest.
30,000	British Electric Traction	10	...	...	...	16½— 17	16½— 17	16⅞	...
10,000	Do. do. 6 % Cum. Pref. 30,001—40,000 £7 pd. (issued at £2 10s. prem. all pd.)	10	...	...	...	10½— 11	10½— 11	...	...
90,000	Brush Elecl. Enging., Ord., 1 to 90,000	3	2½%	*nil*	*nil*	1⅞— 2⅛	1¾— 2	...	...
90,000	Do. do. Non-cum. 6 % Pref., 1 to 90,000	2	3 %	*nil*	4 %	2⅛— 2⅜	2⅛— 2⅜	...	...
125,000*l*	Do. do. 4½ % Perp. Deb. Stock ...	Stock	...	...	...	110 —114	110 —114	113	...
50,000	Do. do. 4½ % 2nd Deb. Stock Red. ...	Stock	...	...	...	102—105	102 —105	...	...
19,894	Central London Railway, Ord. Shares	10	...	...	...	9⅜— 10¼	9⅜— 10¼	10⅛	...
129,179	Do. do. do. £6 paid	10	...	...	...	5⅜— 6¼	5⅜— 6¼	5⅞	...
59,254	Do. do. Pref. half-shares £1 paid ...	...	...	...	...	1¼— 1⅜	1¼— 1⅜	...	...
67,680	Do. do. Def. do. £5 paid ...	...	...	...	...	4¼— 4⅜	4¼— 4⅜	...	...
630,000*l*	City and South London Railway	Stock	1 5/16 %	1 5/16 %	1⅝%	67 — 70xd	70 — 72	71	68
22,500	Do. do. Ord. shares, Nos. 1 to 22,500 £3 pd.	10	...	...	...	2⅜— 3¼	2⅜— 3¼	...	...
32,098	Crompton & Co., Nos. 1 to 32,098	3	...	...	...	1¾— 2¼	1¾— 2¼	...	...
82,850	Do. 5% 1st Mort. Reg. Debs., 1 to 743 of £100, and 901 to 1,070 of £50 Red.	...	...	...	...	89 — 94	89 — 94	...	...
99,261	Edison & Swan Utd. El. Lgt., "A" shares, £3 pd. 1 to 99,261	5	5 %	5½%	6 %	2¼— 2⅜	2¼— 2⅜	2 1/16	2 1/16
17,139	Do. do. do. "A" Shares, 01—017,139	5	5 %	5½%	6 %	4 — 5	4 — 5	...	...
194,023	Do. do. do. 4 % Deb. Stock Red. ...	100	...	...	...	101 —103	101 —103	102½	...
110,000	Electric Construction, 1 to 110,000	2	5 %	6 %	6 %	2½— 2¾xd	2⅝— 2⅝	2½	2⅜
16,343	Do. do. 7 % Cum. Pref., 1 to 16,343 ...	2	7 %	7 %	7 %	3 — 3¼xd	3 — 3¼	...	...
111,100	Do. do. 4% Perp. 1st Mort. Deb. Stock ...	Stock	...	...	...	105 —107xd	105 —107	...	...
91,196	Elmore's Patent Copper Depositing, 1 to 70,000	2	...	...	...	⅜— ⅝	⅜— ⅝	...	...
67,275	Elmore's Wire Manufacturing, 1 to 69,385, issued at 1 pm.	2	...	...	...	¼— ½	¼— ½	...	...
9,600*l*	Greenwood & Batley, 7 % Cum. Pref., 1 to 9,600 ...	10	10½%	7 %	7 %	9 — 11	9 — 11	...	...
12,500	Henley's (W. T.) Telegraph Works, Ord.	10	8 %	10 %	12 %	21 — 22	21 — 22	22	...
3,000	Do. do. do. 7 % Pref.	10	7 %	7 %	7 %	18½— 19½	18½— 19½	...	...
50,000	Do. do. do. 4½ Mort. Deb. Stock...	Stock	4½%	4½%	4½%	112 —117	112 —117	115½	...
50,000	India-Rubber, Gutta-Percha and Telegraph Works ...	10	10 %	10 %	10 %	21½— 22½	21½— 22½	...	...
300,000	Do. do. do. 4 % 1st Mort. Debs.	100	...	...	...	102 —106	102 —106	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	2⅞%	2⅞%	3¼%	10¼— 10⅜	10 3/16— 10 5/16	...	...
10,000	† Do. do. Pref., £10 paid	10	5 %	5 %	5 %	15¾— 16¼	15¾— 16¼	...	...
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	36 — 39	37 — 41	39¾	38¼
150,000	Do. do. do. 5 % Bonds, red. 1899	100	5 %	5 %	5 %	100 —103	100 —103	...	...
540,000*l*	Waterloo and City Railway, Ord. Stock	100	...	...	...	117 —122	123 —128	125	121

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid.

Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

*Birmingham Electric Supply, Ordinary £5 (fully paid) 10⅛.

House-to-House, 4½% Debentures of £100, 105—108.

Kensington and Knightsbridge Electric Lighting, Ordinary Shares £5 (fully paid) 14—16; 1st Preference Cumulative 6%, £5 (fully paid), 8—8½. Debentures, 105—108. Dividend, 1897, on Ordinary Shares 10%.

London Electric Supply Corporation, £5 Ordinary, 3¾—4¼.

*T. Parker, £10 (fully paid), 14¼xd.

Yorkshire House-to-House Electricity, £5 Ordinary Shares fully paid, 8—8½. Dividend for 1896—6%.

* From Birmingham Share List.

Bank rate of discount 2½ per cent. (June 30th, 1898).

THE TELEPHONE INQUIRY.

(*Continued from page* 215.)

The Committee resumed its sitting on Thursday of last week, Mr. Hanbury again presiding.

The first witness called was Sir William Harcourt, and in reply to the Chairman he said he was very much surprised to read Mr. Lamb's evidence, when he said that both he (Sir Wm. Harcourt) and Mr. Goschen were of opinion that if licenses were given to corporations, it should be on the condition that they purchased the local systems of the National Telephone Company.

I should like to have your views on that point, Sir William?—As I say, I was very much surprised to hear that statement made by Mr. Lamb. I took no great part in the details or arrangements about the telephones, but I find that in March, 1893, the question was discussed between the Postmaster-General, Mr. Arnold Morley, and myself, when certain proposals were put forward by the National Telephone Company. Those proposals appear to have been two. The first was as to the constitution of large areas, each comprising several towns, and the second was an undertaking on the part of the Postmaster-General not to grant licenses to municipal or other local authorities. Well, after some discussion on the matter—which, I need not say, I do not bear in my memory, and if I did I should not be prepared to state confidential communications between the heads of Departments—we came to a formal and deliberate decision, which was communicated to the Telephone Company. The result of the discussion of those two proposals between Mr. Arnold Morley and myself is contained in a letter addressed to the National Telephone Company, I think, on March 13th, 1893, in which we expressed our determination to decline to accept either of their proposals, and stated that it was impossible to restrict the freedom of the Postmaster-General in any way to grant licenses—a question which we considered had been closed by the arrangement of August 11th, 1892. That was the substance of the letter which contained the conclusions at which we then arrived.

Did that letter say anything about its being a condition of the working of licenses by corporations that they should purchase the local systems of the National Telephone Company?—Certainly not. The Committee will, I suppose, obtain that letter from the Post Office, but the words which I have taken from that letter were that it was impossible to restrict the freedom of the Postmaster-General in any way.

Mr. Goschen, recalled, was examined on the same point, and he said that to the best of his belief what happened was this—in the course of the debate in the House of Commons on the telephone service he used some phrases, which had been before the Committee, with reference to municipalities being willing to undertake the telephone business themselves, and he said: "I see nothing contrary to the Government policy in such a proposal." He understood that after the conclusion of the debate, the then Postmaster-General, Sir James Fergusson, expressed his surprise at what he (Mr. Goschen) had said, and that Mr. Lamb, who was sitting under the gallery at the time, also was impressed by the fact that that had not formed the subject of discussion before. He understood that he then said to Sir James Fergusson: "I presume that if municipalities are to undertake the business, then they will have to pay for it." Sir James Fergusson's memory was clear upon that point, and Mr. Lamb's memory was absolutely clear, as he understood it on that point, and he certainly could not set his memory in the negative against it. He assumed, therefore, that he said it, but it appeared to him that it was an *obiter dictum* intended for the Postmaster-General and for the officials, because there was certainly nothing to conceal in it. But certainly it had not formed the subject of any discussion among themselves.

The Chairman: Was this private conversation intended in any way to be conveyed to the company, so as to form any part of a verbal understanding with them?—I should say certainly not.

And no one had any right to so convey it?—The matter has never come back to my recollection, or to my notice, until now.

Is the Committee to understand that, in 1892, it was your opinion that such a condition should be imposed on corporations?—As I say, my memory is not clear on that point. I could give the Committee a speculative opinion with regard to it.

What is more important, I think, is your opinion now. Six years have elapsed since 1892. Do you consider now that this condition ought to be attached to the granting of such licenses to corporations?—Now, you are not examining me with regard to Mr. Lamb's evidence, but with regard to my view of the general policy to be pursued, and I am not sure that I should be prepared to give an opinion on that point without examining all that has happened since,

and the various documents, the contents of which have generally passed from my memory.

And the circumstances may have altered during those six years?—That is self-evident; but, speculatively, I should say that I drew a distinction at that time—I gather this from my speeches, and from nothing else—between the places where the Telephone Company had already established areas and places in which they had not. No doubt the policy of the then Government—and I have little hesitation in saying this—was that competition, which we reserved in the strongest possible terms, should be rather kept *in terrorem* over the company, than that competition was to be established. I gather that from the terms of my speeches at the time, and that it was part of the arrangements which were to be made that, if the service was imperfect, in that case there should be competition of one kind or another; but I do not think it was in the mind of the Government of that day, while they reserved the right of competition, that they intended at once, and on any scale, to establish competition with ourselves, or to grant licenses for that competition.

Mr. Bartley: Do you mean to say that this expression to Mr. Lamb was a sort of private official communication to the Department, and in no way intended to be communicated to the company?—No; it was certainly not intended to be conveyed to the company. It was an off-hand expression, as far as I can gather, in reply to a question as to what I had meant when I said this.

And in no way intended to give any moral claim to the company, to be set up on such a casual remark?—Certainly not.

Sir J. Joicey: I gather, from what you have said, that your opinion at that time was that, both in the interest of the public and for the benefit of the Post Office, it was not desirable that there should be two competing authorities in one area?—I think, in my speech in 1895, I said that there would be confusion if in any given area there were several competing companies, and what I said was open to this construction, that it would be more desirable, if at any time a municipality wished to establish its own system, that it should buy the existing system rather than that there should be two systems running at the same time, with all the confusion that might ensue. That is what I may call a speculative opinion in reference to what I said.

And practically you looked upon the National Telephone Company in any particular area as working as a sort of agent for the Post Office?—That is too strong a term.

Mr. Colville: Do I understand you to say that the Post Office retained the right of setting up competitive telephonic exchanges?—Yes, distinctly so, in the event of the service of the National Company being imperfect—imperfect in the sense of not answering the expectations that had been formed of it. I hesitate about giving this opinion, because I have not re-examined the whole subject since the agreement was signed; but I may say, broadly, that it was distinctly the intention to reserve competition in order to prevent any of the abuses or the disadvantages of a monopoly.

Sir James Fergusson was also examined with reference to the verbal agreement, and said that his recollection of what Mr. Goschen had termed his *obiter dictum* was as nearly as possible what the hon. member had just told the Committee.

Sir J. Woodhouse: It was a purely private conversation, I understand?—It was a purely official conversation, and therefore private.

It formed no part of any considered subject with reference to the matters before you at that time?—No.

Mr. Bartley: In your capacity as director of the company, you would not consider that that conversation had ever existed, in fact?—No; but it would remind me of the view taken at that moment, though I am not in the least pretending that is was a settled opinion.

Mr. J. C. Lamb, second secretary to the Post Office, was then again recalled, and said: I should like to make a very sincere and heartfelt apology to Sir William Harcourt and Mr. Goschen for bringing their names into this matter. I fully admit and accept the reproof which Sir William Harcourt has, though very gently, given me for having mentioned a matter of confidential communication. I think I could offer a defence which would appeal to the generosity, if not to the judgment, of the Committee, but I prefer to leave it there, and to say how very sorry I am for having mentioned a thing which they did not intend to be mentioned in public. I can positively assert that I never mentioned this to the company. On the contrary, I urged that nothing of the kind should be said to the company; but I confess I was betrayed into saying something which I ought not to have said, and I wish to make this very sincere apology.

Mr. Lamb then read certain correspondence which had taken place between the company and the Post Office prior to the agreement of 1896. The first letter from the National Telephone Company to Mr. Lamb was dated February 9th, 1893, and in the course of it Mr. Gaine wrote:—

"It has come to our knowledge that a feeling is springing up in certain of the great towns in favour of municipalisation of the telephone service, for the reasons that it is desirable in great and crowded cities that the wires should be placed underground, and that as this involves disturbance of the street, the service ought to be in the hands of the municipality, in the same way as are the undertakings for the supply of gas, water, and electric light, and in one case (Glasgow) this feeling has culminated in action with the Town Council. With the trunk wires connecting town and town in the hands of the company, the company have no reason to apprehend danger, but with such trunk wires in the hands of the Government, the very existence of the company is threatened, should it be the policy of the Department either to favour the municipalisation of the local service, or to give way to the policy under Parliamentary pressure. You may say, and with perfect truth, that the *status quo* has undergone no change since the time when the heads of arrangement were signed by Sir James Fergusson and Mr. Forbes; but there is an essential difference between possibilities and probabilities, and as it has now been brought home to us that the condition of affairs which I have indicated is within the range of practical politics, I venture to think that it is the duty of the board of directors of this company to ascertain the views and policy of the Department, and to safeguard the interests of their shareholders in the pending arrangements before it is too late, and they have parted from their great source of strength, viz., the trunk lines. There are two ways of dealing with the matter:—

"1. The constitution of large areas, comprising within them all the towns surrounding each great centre with which such towns have community of interest, *e.g.*, take the case of Manchester. The company have constituted Manchester and each of the following towns surrounding it, viz., Bolton, Bury, Rochdale, Oldham, Ashton, Stockport and Glossop separate areas. All these places centre upon Manchester, and have close business relations with it, and if they were all put together in one area, the company would have the protection which they have now, and to which they are entitled, because the inter-communication between these towns being in the hands of the company, there would be no inducement on the part of the separate municipalities to set up separate systems. It is true that the constitution of large areas such as I have indicated would trench upon the Post Office revenue, but that might be met by providing for an adequate payment by the company to the Department.

"2. The insertion in the agreement now in negotiation between the Department and the company of provisions rendering it impracticable for the Department to grant licenses to municipal or other local authorities. I would venture to point out that there is nothing in the Treasury minute of last session inconsistent with the insertion of such provisions.

"In conclusion, I have only to add that I am sure you will appreciate how absolutely essential it is for the company, before it is too late, to guard itself against the development of a policy of municipalisation of the local telephone service. The municipality, with the rates at its back, with the right to take up the streets, and the right to prevent the company from doing the like, would be in a position to compete on most unfair terms, and would have, at the same time, all the present experience and knowledge in telephony which the company, who have borne the heat and burden of the day, have assisted so greatly to develop. The company are most anxious and desirous to loyally co-operate with the Department in making the telephone service of the country both thorough and efficient, and are now fully prepared to expend—and, indeed, are now expending—very large sums of money with that object. They are also prepared to stand their chance in any fair competition with a local licensee company, having to raise its capital in the open market, but they would not be justified in surrendering their position of strength without reasonably and properly guarding against the development of a policy which will be bound, in the nature of things, to prove destructive to them."

Mr. Lamb replied on March 13th in the letter referred to by Sir Wm. Harcourt. In the course of the letter he says:—

"The Postmaster-General has given very attentive consideration to these proposals, but he regrets that he does not find it in his power to accept either of them. The question whether the freedom of the Postmaster-General to grant licenses should be restricted in any way was discussed in the fullest manner before the heads of arrangement with the National Telephone Company were signed by Sir James Fergusson and Mr. Forbes on August 11th last. It had been stated to Mr. Forbes in the clearest terms that any such restriction was impossible. The question was closed by the signature of the document to which I have referred, and the Postmaster-General, while fully appreciating the objections to multiplying separate systems in given areas, does not think that any reason has been advanced which would justify him in giving such undertakings as he suggested. As to the areas within which it is proposed that the company shall carry on its operations, there has been, on the part of this Department, a careful endeavour to meet the views of the company, with a due regard to the policy described in the Treasury minute which was laid on the table of the House in May last. On questions of detail the Postmaster-General would still be glad to give his best consideration to any suggestions that might be made by the company, but he is not prepared to discuss a proposal of the effect of which would be to entirely disturb the basis of the settlement which has already been provisionally arrived at between the company and this Department. The Postmaster-General trusts that on further consideration the company will be prepared to carry out the arrangement set forth in the document which received the signature of their chairman on August 11th last, and he would be glad to receive an assurance to this effect as soon as possible."

The Chairman: There were no private letters from you to Mr. Gaine on this subject?—I don't think so.

If there were, would they be filed?—They would be in my own possession, and they could be produced.

Would they be filed as Post Office documents?—I suppose they would. It will be sufficient for me to say that I should have no objection to their being produced.

Was this highly important letter of February 9th, 1893, which throws a flood of light upon the intentions of the company, treated as a confidential document and retained by you alone, or was it filed, as such papers are filed and registered, and open to the view both of the secretary to the Post Office and of the Postmaster-General?—It was certainly open to the view of the secretary to the Post Office and of the Postmaster-General of the day, but I am not able to say whether it was brought before the present secretary to the Post Office and the present Postmaster-General.

Where did you keep this highly important correspondence?—It was kept in the room of my private secretary; but I desire to say that an abstract of the whole correspondence in which these letters are mentioned has been submitted to the Postmaster-General.

Mr. J. S. Forbes, chairman of the National Telephone Company, was recalled, to make an explanation with regard to some remarks made by Mr. Provand at the last sitting of the Committee. The Witness said that in the course of his evidence he had stated that the Mutual Company of Manchester had got hold of people's money on mistaken pretensions. That statement Mr. Provand had characterised as calumnious, but he adhered to it. In the prospectus the Mutual Company promised everybody everything, but they did not fulfil their promises. They had utterly failed as a commercial concern, and had ended in ruin.

The Chairman: It is the prospectus you complain of?—Yes.

But you do not suggest that there has been any misrepresentation?—Oh, no. The prospectus was issued in good faith, but the promises were not carried out.

The Chairman said that he had just received from the Lord Mayor of Manchester a resolution passed by the City Council to the effect that, in their opinion, the telephone service should no longer be in the hands of the National Company as a monopoly. Would Mr. Forbes tell the Committee whether the Manchester Corporation was one of the corporations with whom the company had a special agreement?

Mr. Forbes: Yes.

Mr. Provand, M.P., then approached the table, and asked to be allowed to put in some papers in justice to those gentlemen who had acted with him in connection with the Mutual Company of Manchester.

The Chairman: The question of *bona fides* has been raised and settled, and the whole matter is settled.

Sir Spencer Walpole, secretary to the Post Office, in reply to the Chairman, said he was cognisant of the letter of February 9th, 1893. To the best of his belief he saw it for the first time last Sunday, and the reply of March 13th he saw for the first time last Friday. Before that he was not aware of the existence of those letters, and he did not think he had seen the correspondence which they began.

You had to deal with the final settlement of these questions, and I should have thought it would have been necessary for you to know what had been done by your predecessor on the point?—I can see the importance of that knowledge, but I do not wish to convey the idea that any knowledge has been withheld from me. Whenever I have asked for any correspondence it has readily been given to me.

But this information was not in your possession when these agreements were signed?—To the best of my recollection, no. Papers of this kind are kept in the custody of the particular branch of the Department which is concerned. Mr. Lamb was doing right in keeping these documents in his Department.

Was the letter of February 9th necessarily confidential?—Yes, I think so.

So confidential that the two highest officials of the Post Office knew nothing about it?—I knew nothing about it.

The Committee then adjourned.

The *Times* says that the Committee met on Friday to consider their report. The principal questions with which the chairman (Mr. Hanbury) invited the Committee to deal were: (1) Is the telephone service now, or is it calculated to become, of general benefit; (2) is the Post Office in any way hindered, by legal agreement or by good faith, from competing itself or through licenses with the National Telephone Company in exchange areas; and (3) ought competition to take place? So far, the Committee have not made much progress with their conclusions, but they have agreed upon certain general principles as a basis for recommendation in regard to points of detail, the most important of these being that the telephone service (1) is not at present of general benefit, either in the United Kingdom at large, or even in those limited portions of it where exchanges exist; (2) is not likely to become of general benefit, either in the country as a whole, or in existing or future exchange areas, so long as the present practical monopoly in the hands of a private company shall continue; and (3) as it has already become of much more general benefit in other countries, affording less scope for its development than is afforded by the greater density of population and the greater wealth and commercial activity of the United Kingdom, so it is fitted to become in this country, if worked solely or mainly with a view to the public interest, a valuable instrument in further developing the trade and social life of the nation, towards which new means of communication have always hitherto so largely contributed. Mr. Hanbury invites the Committee to declare that the service given by the National Telephone Company is not generally inefficient, nor, for the class of subscribers whom almost alone it serves, can the rates be considered unduly high, although higher than are paid by similar subscribers in Germany. He thinks, however, that a service already so essential to commercial men, and so well calculated under other conditions to benefit, directly or indirectly, all classes of the community, ought no longer to be treated as the practical monopoly of a private company, a course for which no legal or moral necessity appears to exist, and especially ought not to be worked on a system under conditions which confine its benefits to a limited class in selected areas, permit preferential rates to be charged, and allow a private licensee of a public monopoly to refuse the use of a business necessity to one tradesman and grant it to his competitor under similar circumstances, impose no limitation of charges, and leave the public at large dependent on a service which is in its turn wholly dependent upon innumerable wayleaves held upon very precarious tenure, and nearly all liable to be terminated after six or 12 months' notice. Having arrived at the conclusion that the right to compete is established, Mr. Hanbury next asks the Committee to consider whether competition is expedient, and, if so, whether local authorities should be empowered to undertake a telephone service. In his opinion, competition is both expedient and necessary, in order, first, to extend and popularise the service, and next to avoid a danger, which is by no means remote if no alternative system is in operation, that a purchase of the company's undertaking at an inflated price may be forced on the Government of the day. Amongst the conditions which Mr. Hanbury would impose upon municipalities in this connection are (1) that the system should be one of double wires; (2) that a *maximum* rate should be imposed, and no inducement afforded to carry on the service at a profit with a view to lightening the burden of local taxation; (3) that a *minimum* rate should also be imposed to protect the Post Office against a reduction of rates to a point which would involve an unremunerative service after 1911; (4) and that a royalty of 10 per cent. on the receipts should be paid to the Post Office.

Several private sittings of the Committee have been held this week to consider the report.

THE LONDON COUNTY COUNCIL AND CONTRACTS.

The London County Council is a curious body, and the members seem to think the world was made for them and for the exploitation of their fads. A case in point has just come to the surface in respect of a contract which Messrs. Yarrow & Co. were asked to sign on receiving an order for a shallow draught steam fire float designed on special lines which Messrs. Yarrow had adopted for some gunboats recently built by them for the Admiralty. The contract contained several clauses to which Messrs. Yarrow took exception, notably Nos. 16 and 34. No. 16 clause provides that Messrs. Yarrow (or any other contractor) shall not dismiss or change their foreman unless with the consent of the chief officer (of the County Council), and such chief officer shall dismiss the foreman of Messrs. Yarrow & Co. as and when he think fit, and shall also dismiss any person in the contractors' employ. The clause gives to the County Council power to dismiss any and all persons who may be working for Messrs. Yarrow, just as it may please them. Now we call this a piece of gross impertinence, and it is a common enough clause in other than the contracts of the County Council, even if somewhat modified. A contractor undertakes work, and at the same time he undertakes risks, and has a right to employ whomsoever he likes, and it is simply monstrous that he should be compelled to change and dismiss reliable and able men, perhaps for no better reason than that such men do not suit the conceit of some employé of the Council. Clause 34 provides a penalty of £5 for each and every breach of some fanciful scale of payment for time and overtime, as to which the Council have no business whatever to intervene.

The same clause relates to a schedule of hours of labour, and also enforces that a printed notice shall be displayed of a certain schedule of hours of labour which it pleases the Council to lay down. On the presentation of these outrageous demands, Messrs. Yarrow very properly requested to have returned to them their design, which, however, the Council wished actually to put up to public tender, though it had been prepared by Messrs. Yarrow at their own cost. The only inkling of honesty observable on the part of the Council was an obscure hint to pay something for the plans and specifications. Finally, we believe, it was decided to give up the plans, and so it comes about that London, badly equipped as it is in appliances for fighting fire, must now be indefinitely deprived of a badly needed float because the London County Council prefers to risk any number of fires rather than give up its pettifogging interference with contractors, and the power of working mischief between employers and employed, which culminated last year in the strike and lock out. Messrs. Yarrow have, in fact, been first requested to undertake costly experimental work for the benefit of the Council; then they are awarded the work on impossible conditions. Messrs. Yarrow decline to give up the management of their own works to any official it may please the County Council to put in. The net result is that the best firms, best fitted to undertake the best work at the cheapest rates possible for good work are really out of the running in County Council contracts. London's work is tendered for by a limited number of firms, which does not include many of the best ones, and the ratepayers, who can ill afford it, are mulcted to the tune of many scores of thousands of pounds per annum in order that a certain class of the community may pose as benefactors to the working classes. Yet what is the truth as to wages. Messrs. Yarrow pay their men better wages than the run of trades unionists obtain, but they are not to be ordered to pay such wages to every loafer who would get into the works under the ægis of the County Council. It is to this end that the County Council's gospel inevitably leads. It is well to protest at once against the re-introduction of the thin end of the wedge which worked such havoc to both masters and men last year, and brought down both wages and profits, as well as depriving this country of much trade which went abroad.

REVIEWS.

Elementary General Science. By A. P. Simmons, B.Sc., and L. M. Jones, B.Sc. London: Macmillan & Co.

We are not particularly impressed with this attempt to teach elementary general science by means of a small book of some 330 pages. The information given is undoubtedly

perfectly sound and very concise, but we very much doubt if any student, taking the book up with the idea of preparing himself for a matriculation examination, would be able to gain a sufficient insight into the subjects treated of. Condensation is all very well if it is not effected at the sacrifice of clearness. As regards accuracy, the authors may be thoroughly depended on, and the book is quite reliable; but it is very questionable, we think, if, as an elementary science primer, it can prove a success.

The Calorific Power of Fuels. By Herman Poole, F.C.S., M.Am.Soc.C.E., &c. New York: Jno. Wiley & Sons. London: Chapmam & Hall. 1898.

This book is founded upon Scheurer-Kestner's "Pouvoir Calorifique des Combustibles."

No doubt many engineers will have experienced the difficulty of searching out from many books the information that Mr. Poole has endeavoured to gather between the covers of the one before us. It is distinctly a work on fuels, and, as such, the author has, perhaps wisely, confined himself within comparatively narrow lines. At the same time, we could wish he had gone a little further in adding further to his own very excellent tables. The additional information we should have desired is equally appropriate tables of specific heat, in order that, for purposes of engineering calculations, an engineer might have all his heat tables in one book. While commenced as a simple translation of Scheurer-Kestner's work, changes have been introduced to adapt it to American methods, and it goes without saying that it is equally suited to English methods, its American parentage, however, giving it a very full table of American fuels, and a rather general table only of English coals. We find no word at all of Australian coals, though New Zealand is fairly well represented.

The author defines the calorie and the British thermal unit, and passes on to the calculation of heat of combustion from the chemical composition. The method of calorimetric evaluation by calculation, however, is so confused by errors due to the presence of more or less complex bodies and the variety of their exothermic qualities, that it has given way except for approximations to the calorimeter method of actual trial. Modern apparatus has brought about this result.

Various calorimeters are described and illustrated, and the litharge method is condemned as unreliable and even misleading. Directions for using calorimetric apparatus are given, and for calculating the value of the apparatus itself in taking out the necessary corrections. Fabre and Silbermann determined the corrections for their own apparatus once for all by a series of experiments. These chemists published their first researches in 1852, and their figures are largely standard to this day. Their apparatus is described, together with the changes made by subsequent observers.

The use of the calorimeter is explained, because its conditions can be everywhere realised, but the method of the bomb is better when oxygen at 25 atmospheres is available. With the bomb and constant volume method any ordinary compressed oxygen may be used, even up to 10 per cent. of nitrogen.

Mahler used compressed oxygen, which is purchaseable in Paris at 120 atmospheres.

Coal being the leading fuel of the world, is accorded the chief space in this book. Nearly all known coals have been tested by the calorimetric method, and the tables given are very full.

Hard wood is less calorific than soft wood, a fact rather the reverse of popular opinion as to the power of timber in firing.

The section on gaseous fuels is fairly full, including the natural gases, and going thoroughly into the method of calculation of temperatures of various gases. Figures are given of the calorific values per kilo., and per cube metre. There is also a section on flame and flame temperatures. The nominal temperature of hydrogen burned with oxygen is 6,727° C., but the highest temperature obtained is actually only 2,500° C., the difference being due to dissociation.

Here we observe a misprint. On page 169 the specific heat of aqueous vapour is given as 0·475. On page 170 it is used in calculation as 0·479, and the figure 6,727 is obtained thereby. With the specific heat of 0·475 this figure would be 6,783° C. The correct specific heat is 0·479, however, and the error is that on page 169.

The author does not guide us at all in the vexed question of dissociation *versus* increase of specific heat at high temperatures.

In an Appendix are given the American standard rules for boiler testing, numerous tables of heat, of combustion, of substances, thermometer reduction, theoretical flame temperatures, and others of value.

In the table of coal values, very few of the United States coals go beyond 15,000 heat units per pound, two Nova Scotian coals touch or exceed 16,000, and four of the United States coals do so, none of which is an anthracite. Ten French coals exceed this number, but no English coal is credited with so great a capacity as 16,000, the nearest, Nixon's navigation, falling below by 45 units. The figures of the analyses do not seem to bear out altogether the calorific values given, and there are many obvious errors in the table of English coals, the sum of the fixed and of the volatile carbon not being correctly added to the total carbon. The results are hopelessly discordant, requiring amendment for the majority of the coals of Great Britain.

In pointing out such errors as we have observed, we do so not in a captious spirit, or to undervalue the book, which every engineer should have.

General Elementary Science. The University Tutorial Series. Edited by William Briggs, M.A. London: W. B. Clive, University Correspondence College Press, 13, Bookseller's Row, Strand, W.C.

This is another attempt to compress a large amount of information into a small space, and is more or less successful, in so far that the book is of more respectable dimensions than others in which the same task has been undertaken, though it may be doubted whether it is sufficiently full for the purpose required. Writers or compilers of books of the kind have themselves mostly acquired their knowledge by studying from a number of treatises, each dealing with a special subject, and unconsciously they imagine that the condensations they put together can impart, clearly and easily, information which is really only to be properly grasped by the help of separate works, and not by a number of sections, each consisting of a few pages.

The book in question is, however, the work of authors whose knowledge of the subjects they write about is thoroughly sound, and such information as is given is therefore quite reliable. A number of excellent examples are given at the end of each chapter, and also the answers to each. The three sections into which the book is divided treat of "Mechanics," "Heat, Light, and Electricity," and "Chemistry." The subject of electricity is touched upon in but 34 pages.

Practical Organic Chemistry for the Elementary and Advanced Examinations of the Science and Art Department. By George George, F.C.S. London: W. B. Clive, University Correspondence College Press, 13, Bookseller's Row, Strand, W.C. 1s. 6d.

This little book appears in the "Organised Science Series" which is being issued by the University Correspondence College. It is intended primarily for the use of students preparing for the elementary or advanced stage of the Science and Art Department's examination in practical organic chemistry, and it seems to fulfil this object very well. We rather expected to find that it was more or less of a cram book, but though the passing of examinations has been kept prominently in view by the author, we think that he has succeeded in producing a work which will be useful to the general student of chemistry. The system upon which the tests are arranged is sound and practical, and the chapters are not marred by frequent mistakes. The index is rather scanty, but then the book does not pretend to be a work of reference. The only real fault that can be found with it refers to Chapter VIII., in which instructions are given for the preparation of some of the re-agents used in organic analysis. These instructions should have covered all the re-agents, and they should have been much more explicit than they are. We should not like to trust a student to prepare his re-agents by means of them, since they are too brief, and not always clear.

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS.—1898.

Compiled expressly for this journal by W. P. Thompson & Co. Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, Manchester, and Birmingham, *to whom all inquiries should be addressed.*

16,135. "Improvements in electrical heating apparatus also applicable for use as electrical resistances." J. T. Niblett and M. Sutherland. Dated July 25th.

16,155. "Improvements in the globes of electric incandescent and similar lamps and lamp shades or chimneys." English Industrials, Limited, and G. E. Heyl-Dia. Dated July 25th. (*Complete.*)

16,172. "A voltaic battery cell with hot air depolarisation." H. de R. de Lavison. Dated July 25th.

16,245. "A new or improved electric sounding device." J. P. Buckley and W. A. Croffut. Dated July 26th. (*Complete.*)

16,257. "Improvements in starting switches and regulators for electric motors." J. R. Garner. Dated July 26th.

16,263. "Improvements in and connected with the laying of electric cables." A. Cleaver. Dated July 26th.

16,267. "Electric communicator for use as a means of communication between passengers and guards or drivers of trains." G. Armstrong. Dated July 26th.

16,291. "Improvements in alternating current transformers." L. M. J. C. Levasseur. Dated July 26th.

16,299. "An alternating current transformer for induction coils." M. Kohl. Dated July 26th. (*Complete.*)

16,351. "Improvements in or connected with dynamo-electric machines." J. Marr. Dated July 27th.

16,352. "Improvements in or connected with incandescent electric lamps." W. H. Macfadyen and J. Ferguson. Dated July 27th.

16,376. "Electro-magnetic bearing for shafts subjected to end thrust." E. N. Stoney and A. Sharp. Dated July 27th.

16,385. "Improvements in electrical fire alarms." H. A. Olsson. Dated July 27th.

16,396. "Improvements in and appertaining to the working of incandescence electric lamps." D. MacLagan. Dated July 27th.

16,460. "An improved automatic device specially applicable to three-wire or balanced systems of electric distribution generally." Veritys, Limited, and L. J. Steele. Dated July 28th.

16,464. "Improvements in the construction of electrodes for secondary batteries." A. Henneton. Dated July 28th. (*Complete.*)

16,469. "Improvements in the manufacture of electric telegraph and telephone cables." L. T. B. Saunderson. Dated July 28th.

16,473. "Improvements in gearing for electric motor cars." G. R. Blot. Dated July 28th.

15,488. "Improvements in the method of and apparatus for starting and controlling electric motors." T. Preece and J. A. Edmondson. Dated July 29th.

16,522. "Improvements in electric arc lamps." R. H. Cunningham. Dated July 29th.

16,552. "Improvements in electric arc lamps." H. Bremer. Dated July 29th. (*Complete.*)

16,553. "Improvements in electric arc lamps." H. Bremer. Dated July 29th. (*Complete.*)

16,556. "Improvements in galvanic batteries." A. J. Benedict. (W. S. Doe, United States.) Dated July 29th.

16,590. "Improvements in and relating to secondary batteries and the like." C. Levetus. Dated July 30th.

16,592. "Improvements in wave or current operated motors." G. Hughes. (G. Lofgren, United States.) Dated July 30th.

16,595. "Improvements in electric heaters." H. Lyon. Dated July 30th.

16,599. "Improvements in and relating to electric tramways and railways." J. Robson. Dated July 30th.

16,602. "Improvements in drums for holding electric cables and in covers to be used with such drums." T. Oxley. Dated July 30th. (*Complete.*)

16,659. "Electrolytic process for extracting metal from their halogen combinations." Dr. E. Stilberg. Dated July 30th. (*Complete.*)

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, Manchester, and Birmingham, *price, post free,* 9d. (*in stamps*).

1898.

125. "Improvements in controlling electric motors and switches therefore." K. Bowen. Dated January 3rd, 1898. Relates to a switch whereby it is possible to increase the speed of an electric launch for a short interval, and consists of a cylinder of ebonite or other suitable material, mounted on a spindle working in bearings and provided with a handle. On the surface of the cylinder are fixed metallic bridge pieces in suitable positions, on which bear fingers mounted on an insulating block to which the electric connections are made by means of thimbles. The cylinder is provided with a ratchet wheel and a pawl, and the whole is mounted on a metal casting. 3 claims.

729. "An electrically operated machine or tool for cutting fabrics, paper, and the like." F. Gardner and D. Smith. Dated January 11th, 1898. Relates to an electric rotary cutter, and comprises a base plate upon which is supported a guard plate, which extends around the periphery of the cutter to protect the edges, the cutter being mounted upon the exterior rotating part of an electric motor, which is supported from above. Means are provided whereby the motor may be adjusted in position, so that as the cutter is worn away by use and repeated sharpening, the motor may be moved to maintain the cutter in the most effective position for operation. 6 claims.

1,697. "Apparatus for the electrolytic treatment of bleaching liquids." M. Mass. Dated January 21st, 1898. Relates to apparatus for the electrolytic treatment of bleaching liquids, and consists of a number of upright electrodes arranged at approximately the centre of the liquid, and below the electrodes dead chambers are formed. The said chambers receive the slime from the liquid, thereby obviating a short circuit being formed between two electrodes. 2 claims.

2,991. "Improved double arc lamps." W. Mathieson. Dated February 5th, 1898. Relates to an improved arc lamp with two independent clockwork mechanisms, in which the release of the one clockwork mechanism after the consumption of the other pair of carbons is effected by a lever provided with projections, and actuated either mechanically or electrically, the lever being arranged alternately to stop or release the said clockworks in such a manner that each pair of carbons can be renewed separately. 3 claims.

3,259. "Improvements in the construction of apparatus for producing and receiving Hertzian electric waves" E. Ducretet. Dated February 9th, 1898. The apparatus for producing the electric waves is an oscillator the construction of which allows of the immersion of the spheres in an insulating liquid, at the same time securing from the outside their junction or separation and the possibility of observing the sparks which shoot out. The regulating of the separation is executed from the outside, thus avoiding acting upon them from the top. 5 claims.

3,841. "Improvements in the method of and means employed for connecting electric glow lamps to main conductors." F. Palm. Dated February 16th, 1898. The head of the lamp is filled with cement in which two pressure springs in contact with the ends of the platinum wires connected to the fibres are fixed. These pressure springs are bent at their outer ends, so that they will clip and hold on wires and receive the current from them. The surface of the cement in the head has a covering of paraffin wax. 3 claims.

3,925. "Improvements in electric safety fuses and lamp connections." W. C. Gover. Dated February 16th, 1898. Relates to a construction of an electric safety fuse. It consists of a base of insulating material on which is screwed a cap, it has projecting up from it a curved partition consisting of two side and a middle part extending some height above the base. On the outside of each partition is fixed a terminal. The two terminals are connected by a fuse wire. 2 claims.

3,993. "Improvements in or relating to electric ignition devices for internal combustion engines." A. J. Boult. (The Société Nouvelle des Etablissements Decauville Aîné.) Dated February 17th, 1898. Relates to electric ignition devices for internal combustion engines, and consists chiefly of a platinum wire maintained in an incandescent state by means of an electric current, and arranged so that its position relatively to the explosion chamber can be adjusted as desired for the purpose of enabling the working of the motor to be regulated by advancing or retarding the period of ignition. 2 claims.

4,999. "Improvements in and relating to electric railways on a road contact system." W. M. Brown. Dated March 1st, 1898. Relates to that class of railways in which a bared conductor in disconnected sections forms one side of the working circuit. One terminal of the dynamo at the power station is connected to the rails of the track, while the other is connected by intermediate feeders and sub-feeders to the switching mechanism. The switching mechanism is ordinarily open, so that no current is delivered to the top of the box, but it is closed by the field of a magnet carried beneath the travelling vehicle. A collecting shoe which makes contact with the box when the aforesaid magnet is above the box, the current of which is delivered to the circuits upon the vehicle. 5 claims.

5,863. "Improvements in incandescent electric lamps and in processes for manufacturing them." W. L. Voelker. Dated March 10th, 1898. Relates to the use of the carbides of the following metals, viz., uranium, thorium, ytterbium, erbium, cerium, calcium and magnesium for manufacturing filaments for use in incandescent electric lamps. 2 claims.

6,223. "Improvements in or relating to conductors for electric railways." B. Seaton (C. M. White). Dated March 14th, 1898. Relates to a conductor for electric railways. The conductor consists of a web fitting between an upper insulating strip and a lower insulating strip. At each edge of the web is a flange, the vertical flange forming the contact service for the shoes, and the horizontal flanges serving to keep the shoes from moving vertically out of contact with the vertical flanges. 10 claims.

8,085. "Incandescent electric light decorations." A. A. Pollock. Dated April 4th, 1898. Relates to decorations for electric glow lamps. The lamps are enclosed in artificial flowers, made of paper, cloth, or any other suitable material, the leaves of the flowers are made of a framework of wire to which the paper is secured. 2 claims.